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VETERINARY MEDICINE

APRIL CONTENTS 1947

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There is, as yet, scarcely a hint that any of the pathogenic viruses are susceptible to attack by chemotherapy.

Virus diseases cannot be adequately controlled until scientists have formulated a better understanding of latent or hidden infections.—*Karl Meyer.*

Dr. Alfred reports in *Public Health Reports* that an extract of California Spanish moss retards the progress of tuberculosis in guinea pigs. No toxic effect of the treatment was apparent.

That streptomycin is not a cure for tuberculosis but it apparently is of great value as a stopgap along with other recognized treatment, is the verdict of the National Research Council's committee on therapeutics and other agents.

Adrenalin in oil, 1 to 500, is said to prolong the effect of the drug in urticaria, asthma and serum shock, from 9 to 12 hours beyond the time the effects would pass off when it is given in aqueous solution. The solution of adrenalin in oil is given intramuscularly and the dose is the same as for the 1 to 1000 aqueous solution.

A bill has been introduced in the Senate at the request of the Federal Security Administrator which would amend the Federal Food & Drug Act by providing that all batches of drugs composed wholly or in part of streptomycin or any derivative thereof be certified. Insulin and penicillin are the only other drugs which now require such certification.

An extract of brain tissues is said to be as effective as penicillin against *Staphylococcus aureus.*

President Truman has asked the continuance of controls on streptomycin. This is one of eight groups of items over which he wishes Congress to continue controls beyond March 31, 1947.

Grisein is the name of a new antibiotic agent discovered by Doctor Waksman, famed Rutgers University discoverer of streptomycin. Grisein is a sort of teammate of streptomycin, named for the species name of Streptomyces griseus. The value of grisein, when combined with streptomycin, lies chiefly in overcoming the resistance of some bacteria to the latter agent.

A threefold or better concentration of penicillin in the blood may be secured by the use of a new drug, caronamide, is the report from the Medical Research Division of Sharp & Dohme, which has made successful tests of the drug on dogs and persons. It is expected that with the use of coronamide with penicillin the treatment will be more effective and may require less frequent dosage.

A new drug, furacin, is reported by scientists of the Boston City Hospital and Tufts College Medical School, to be gaining recognition as an effective agent against disease-producing bacteria which invade the skin. It seems to be particularly effective in superficial infections of the skin such as impetigo and ecthyma. When used topically in large amounts over long periods there has been no evidence of poisoning by absorption.

U. S.-Mexico Cooperate in F&M Disease Control

By action of the congress and approval of the President, the USDA and the Department of State are authorized to cooperate with any other government in the control and eradication of foot-and-mouth disease and rinderpest when either of these disease endanger the livestock industry of the United States.

Cooperation with Mexico in combatting the present outbreak of foot-and-mouth disease in that country will begin at once. Personnel, equipment and materials, for operation in the field, and a laboratory will be furnished by the United States.

The Mexican-United States Agricultural Commission met March 6th to consider the question of cooperation between the Governments of Mexico and the United States in a program for eradication of foot-and-mouth disease in Mexico.

The Commission passed the following formal resolution:

CONSIDERING:

RESOLUTION

That the eradication of foot-and-mouth disease in Mexico and the prevention of its spread into the United States will require vigorous action lasting over a considerable period and involving intricate administrative and supervisory problems, and the handling of extensive funds, and will often require prompt decision and action under competent direction, the Mexica-United States Agricultural Commission

RECOMMENDS:

1. That there be established in Mexico City at the earliest possible date a joint office for the eradication of foot-and-mouth disease.

2. That this office be administered by a director and a co-director who shall be jointly responsible for the active direction of the campaign against foot-and-mouth disease, and for the expenditures of funds supplied by the two Governments for that purpose. The director should be a Mexican citizen appointed by the Mexican Secretary of Agriculture and livestock industry. The co-director should be a United States citizen appointed by the United States Secretary of Agriculture.

3. That there be established a joint administrative board for the eradication of foot-and-mouth disease to which the director and co-director shall be responsible. This board shall be responsible for the policies and procedures to be followed by the office. The board shall consist of three members appointed by the Mexican and three by the U. S. Secretary of Agriculture and the director and co-director of the office.

4. That the Mexican and United States Sections of the administrative board should each arrange for the appointment of an advisory committee consisting of such persons as may be desired .

The Commission considered the question of the financing of the office recommended in the above resolution but deferred a final recommendation on this point pending further consultation with their respective Governments. It is hoped that a definite conclusion on this point can be reached within a week.

The Commission also considered the problem of securing supplies in connection with the control and eradication program now in effect in Mexico and related problems that will result from the campaign. Assurances were given by the United States Section that every possible assistance would be given to the Mexican authorities in locating such equipment and supplies in the United States.

* * * *

There are 60 million goats in India; 350 million cattle.

* * * *

No evidence has been produced indicating that *Salmonella cholera suis* can survive for lengthy periods outside the body of the animal. The reservoir of infection in a piggery appears to be in the living animal. Latent infections, in which pigs remain carriers of Salmonella and yet show no sign of infection, are common.—*Australian Vet. J.*

The National Society for Crippled Children, through the sale of Easter seals, procures funds which are used, in addition to other activities, to aid individuals to develop skills for work. It provides instruction in toymaking and piecework for the crippled who are unable to leave home. It also aids in selling these products.

* * * *

The outbreak of foot-and-mouth disease across our southern border and the prospect that many American veterinarians may soon be engaged in the attempt to subdue it, has centered much attention, for the first time in 18 years, on this plague of the cloven-hoofed species. While there can be no curiosity to learn what it is like to live with foot-and-mouth disease, the fact that Holland is planning to vaccinate all its susceptible cattle annually for the prevention of this plague takes on an added interest.

The national committee on Newcastle disease has modified its objection to poultry shows. It now sanctions them where "they are determined to be in the public interest" and "held under regulations designed to minimize the likelihood of dissemination of the disease through such shows."

Oven-prepared, pan-ready frozen poultry is increasing in popularity with housewives all over the country, but less on the eastern seaboard than elsewhere. Availability of fresh, cut up chicken has increased largely the sale of poultry in many markets.

Dr. K. B. DeOme, University of California, reports that laryngotracheitis is readily communicated from barnyard fowl to wild birds. Presumably, the infection can go the other way also, and thus English sparrows and other birds may carry the disease from one farm to another.

The British have made the first purchase of the year of dried whole egg powder as announced by the USDA. This first shipment of their purchase program was 10 million pounds which required one million cases of shell eggs. They were supplied 97.5 million pounds of dried eggs in 1946.

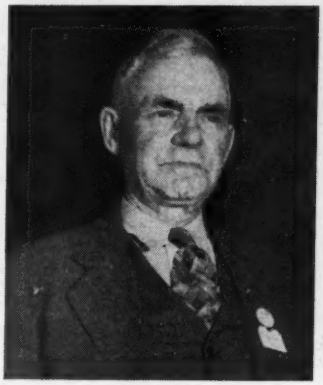
Hybrid, judging from its employment, is the most effective word that can be used in advertising corn or poultry. The word is derived from Greek *hybris*, which means outrage. In this instance it is fortunate that the Greeks had a name for it. "Outrage" would not sell many baby chicks.

I think it better to omit poultry from the veterinary curriculum and have an 18-month post graduate course in poultry husbandry for those who contemplate making poultry their main source of income. A course of six months didactic and 12 months of practical work would be almost ideal.—W. P. Blount, M.R.C.V.S., in *The Veterinary Journal*.

There are 174 varieties of chickens listed in the latest edition of the American Standard of Perfection. One-hundred-one of these are known as fancy breeds—bantam, game, Oriental, etc. However, the five most popular breeds make up 95% of the chicks distributed by commercial hatcheries. They are white Leghorns, barred Plymouth Rock, white Plymouth Rock, Rhode Island red and New Hampshire.

Pioneer Veterinarian Dies

Dr. James H. Spence, ONT '90, Clinton, Iowa, died Feb. 21, 1947, from pulmonary embolism following an operation for cholelithiasis. Doctor Spence was born in St. Mary's, Ontario, in 1866, and had practiced in Clinton for 55 years.



Dr. James H. Spence

Despite his 81 years he was active, even sprightly. With Mrs. Spence, who survives him, he attended most veterinary meetings held within 200 miles of his home. None can remember when they failed to attend the Eastern Iowa meeting at Cedar Rapids. Last August they drove to the Boston Meeting of the A.V.M.A. and returned *via* Ontario where they attended a family reunion at which there were seven brothers of Doctor Spence, all over 70 years of age.

All dogs coming into the United States except from Canada, Great Britain, Australia and New Zealand must have been vaccinated for the prevention of rabies within six months of entry.

Under ideal conditions, if one were not faced with problems of packaging and rancidity, dry dog foods should contain 10 to 20% fat. Much progress has been made in the stabilization of fats during wartime. Can these stabilization products be used in preparing dog feeds?—*C. M. McCay.*

No investment of the average man gives more pleasure than that he puts into his dog. Therefore he should be willing to purchase high grade feed stuffs just as he buys good materials in the form of an automobile or radio. Further he should insist that dog feeds have genuine merit backed by research and not just baseless claims.—*C. M. McCay.*

Thrombin, buffered by a phosphate solution, is reported by B. M. Daly of Wayne University, to stop hemorrhage in the stomach and upper intestinal tract.

Benadryl (B-dimethylaminoethyl benzhydryl ether hydrochloride) a synthesized antihistamine agent has shown encouraging results as a palliative for urticaria angioneurotic edema, erythema multiforme. One of its uses is the systematic treatment of urticaria in patients undergoing penicillin therapy.—*Brit. Med. J.*

Health is a balanced state of physical, mental and social well-being, and not merely the absence of disease or infirmity.

Doctors at the University of Michigan, by experimenting with rabbits, learned that transverse abdominal incisions heal quicker and complications are fewer than is the case with the conventional longitudinal incisions. Their patients go home from the hospital earlier after gallbladder, stomach and intestinal operations, since horizontal instead of vertical incisions were adopted.

Major Walter A. Lawrence, post veterinarian, examining a Spitz in the clinic of the Dog Overseas Replacement Depot (DORD), Camp Kilmer, N. J. As preparation for overseas movement, all dogs arriving at the DORD are given a complete physical examination. The civilian pets are shipped overseas to military and civilian personnel of the War Department at the expense of the owners. The Dog Depot is complete with barracks, mess hall, clinic, infirmary and stockade. It was set up and is commanded by Major Lawrence, V.C., who is owner of the Blue Cross Hospital, San Antonio, Texas

There are about 20 times as many cases of diabetes as there are of infantile paralysis.

Forty medical officers were killed in action in World War II and an additional 128 died while in the military service. Of those killed in action, 30 were killed in the Pacific war, nine in Europe and one in Africa.

The use of powdered red blood cells, a discard from blood plasma banks, as aid to penicillin in severe or stubborn infection in wounds or burns, has been reported to the American College of Surgeons by Dr. Felix Jansey of the Northwestern University Medical School.

The hemoglobin of the blood powder is instrumental, when sprinkled in the wound, in keeping a higher concentration and for a longer period than can be obtained by the injection of penicillin, and the hemoglobin is not irritating to the wound.

According to Woltz and Wiley, University of Pennsylvania School of Medicine, penicillin is highly successful in the treatment of congenital syphilis; reaching the fetus as early as the 10th week of gestation, when administered to the mother. Arsenical preparations do not reach the fetus earlier than the fifth month of gestation and even then often in insufficient concentration to be effective.

In dental surveys among five-year-old children in London schools in 1929, 1943 and 1945, marked improvement was found in the 1943 survey as compared with conditions existing in 1929. Again in 1945 the survey shows much improvement over the conditions revealed by the survey two years earlier. It is suggested the better condition of the teeth of five-year-olds in 1943 and 1945 is due to the diet made available to pregnant women, infants and young children in England during the late war.

A report from the office of the Surgeon General of the Army announces that there have been apparent clinical arrests of undulant fever from the combined use of streptomycin and sulfadiazine after each drug, given alone, had failed. Further study is required.

ALEXANDER K. SUTHERLAND

Dr. A. K. Sutherland, Queensland, Australia, has been appointed to the staff of the University of Illinois, College of Veterinary Medicine, to be assistant in Veterinary Pathology and Hygiene. Doctor Sutherland received his veterinary degree in 1937 from the Faculty of Veterinary Science, University of Sydney. From 1937 until 1942 he was Assistant Veterinary Officer on Animal Disease Control in the Commonwealth Department of Health, Canberra. He was Veterinary Officer at the Animal Health Station, Yeerongpilly, Queensland, from 1937 until his appointment to the University of Illinois

The President's Conference on Fire Prevention

The President has called a national conference on fire prevention to meet in Washington, May 6, 7 and 8. More than 2,000 delegates are expected to attend the conference, representing federal departments, state, county and municipal governments and business and civic organizations with a basic interest in the fire prevention problem.

The conference will doubtless accomplish much as did the highway safety conference last year. But, regardless of public effort, the prevention of fires is largely an individual problem—a problem of fire prevention by the individual on his own premises. And it isn't necessary to wait till May to make a start.

The fire record in this country is an appalling one; the average annual toll being 10,000 lives and in 1946 a property loss exceeding $560 million. Again it is emphasized, fire prevention concerns mainly the individual. The 10,000 lives sacrificed were lives of individuals; the millions in property loss was mainly a loss to individuals.

Approximately 300 chemical, physical and infectious agents are known to possess a capacity for initiating carcinoma. They include aniline dyes, petroleum products, radium, cobalt, nickel, oils, amino compounds, ultraviolet rays, etc.

The USDA has set 120 billion pounds as the milk production quota for 1947. It will require 25 million average cows to produce that amount; but if the average production of all cows were as high as the average of cows belonging to members of the dairy herd improvement associations it would require only 14 million, not 25 million cows, to produce 120 billion pounds of milk. There is a lot of work and cost, too, to pasturing, stabling, feeding and milking 11 million unnecessary cows.

Forty years ago the first cow-testing association in the United States was organized at Fremont, Michigan, by 31 dairymen. Now there are 1124 cooperative, cow-testing, or dairy herd improvement associations, as they are now called, having nearly 25,000 members in this country. In 1945 the average production of the 628,000 cows belonging to association members was 8,592 pounds of milk and 346 pounds of milkfat per cow. The average production of all dairy cows in that year was 4,789 pounds of milk and 190 pounds of milkfat.

Florida Veterinarians Show the Way

The next eight articles are from the program of the 17th annual meeting of the Florida State Veterinary Medical Association. These papers constitute approximately one-half of the program of the meeting. One is not getting far off base to say that of not one state veterinary meeting in 50 does one-half of the papers presented appear in any veterinary publication of general circulation or in all such publications combined. That one of the youngest of the state veterinary associations should have achieved this in 1946, reflects much credit on Secretary Bruns, President Emmel and others, responsible for a program of this quality. And a good deal is to be said for the veterinarians of a state, where more than 75% of their number belong to the state association, as is the case in Florida, and where the attendance at their state meetings equals the total membership of the association as was also the case in Florida last fall.

Another evidence of the esprit du corps of the Florida veterinarians: In subscriptions to the A.V.M.A. research fund, Florida was over its quota before the whole country had attained the halfway mark.

Possible Use of an Arsenical Compound in the Treatment of Heartworm in Dogs*

By GILBERT F. OTTO
and THOMAS H. MAREN**
Baltimore, Maryland

IN the search† for a chemotherapeutic agent against the filaria *(Wuchereria bancrofti)* which causes elephantiasis in man, much of the experimental work was carried on with *Dirofilaria immitis,* the heartworm of dogs. Studies with various trivalent antimony preparations failed to reveal any suggestion that any of these could be expected to kill the adult filaria with any degree of dependability even with heavy doses. Pentavalent antimonials likewise offered little hope of success. We, therefore, undertook a search for a non-metallic compound but failed to find one with promise. *In vitro* studies, however, indicated that trivalent arsenic in the form of phenyl arsenoxides had an *in vitro* filaricide activity much greater than anything hitherto reported for any compound. Preliminary *in vivo* screening against the filaria, *Litomosoides carinii,* in the cotton rat confirmed an extraordinary killing effect against the adult filaria. Of these therapeutically effective phenyl arsenoxides some were discarded since they had an unfavorable therapeutic index but several with more favorable therapeutic indices were selected for further study. Of these p-arsenosobenzamide (T.D.C. 622) was shown to kill, regularly, all adult heartworms in dogs with doses which were easily tolerated. The compound, however, is only slightly soluble in water (about 1 part in 800). In a search for a more soluble analogue of this compound T.D.C. 970 was synthesized. In this compound the oxygen of the p-arsenosobenzamide is replaced by two thioglycollate radicals; its chemical name is p-[bis-(carboxymethylmercapto)-arsino]-benzamide. This compound is much more soluble than T.D.C. 622 and 2% solutions have been used in most of our work. This compound in daily doses of 1mg (0.2gm As) per kilogram of body weight for 15 days has regularly killed the adult filaria in dogs but has failed to reduce the microfilaria blood level. The same total dose, i.e., 15 mg (3.0mg As) per kilogram, given either entirely within five days or given every other day for 30 days, failed to kill all the adult filaria. The acute LD_{50} in mice is approximately the same for this drug as for mapharsen and it is well tolerated by monkeys, dogs, and other laboratory animals in daily doses far in excess of the therapeutic dose. For instance, it was given without any discernible ill effects to dogs in daily doses up to 4.5mg (0.9mg As) per kilogram for 42 days and in the same doses to monkeys for 21 days. Studies on excretion and on tissue retention failed to reveal any appreciable accumulation of arsenic in any organs, with any but fatal doses of the compound. Furthermore, arsenic was detected in appreciable amounts in the dead filaria of animals treated with this compound. In our studies none of the dogs showed symptomatic disturbances as a result of the dead worms but on necropsy in some cases appreciable gross pathology in the lungs as a result of blockage of the pulmonary arterioles was seen. It must be noted, however, that all animals were continuously confined to small cages so that exercise was reduced to a minimum. Clinical trial in dogs under conditions of routine veterinary practice is now being carried out by Dr. Ronald Jackson to determine whether or not this agent is suitable for general use.

*Read by Dr. Ronald Jackson, St. Augustine, Fla., at the 17th annual meeting of the Florida State Veterinary Medical Association, Oct. 29-30, 1946, St. Petersburg.

**Department of Parasitology, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.

†This work was done under a contract recommended by the Committee on Medical Research initially between the Office of Scientific Research and Development and the Johns Hopkins University and continued between the Office of the Surgeon General, U.S.A. and the same University.

Sterility in Cattle

By W. A. Hornaday
Greensboro, North Carolina

PREFACING my remarks on sterility I would like to state that I am just a general practitioner, like many of you here today; I am not a teacher nor a scientific investigator, hence I am able to speak only of matter of a practical nature. I became interested in sterility work several years ago, and fortunately have had a number of large, valuable herds to practice in, which, of course, is very advantageous if one is to become proficient in this line of work. The need for much practice in order to become proficient in sterility work is due to the hidden nature of the causes of sterility and the necessity of developing and maintaining a keen sense of touch in order to recognize pathological conditions in the reproductive organs. It is my opinion, however, that there is no type of work in cattle practice more valuable to the breeder than that of a systematic examination of the entire herd, to determine the breeding status of each animal. This examination should be made at least quarterly and in some herds more often. This is especially true in purebred herds, where many of the cows are of such value that it is very desirable to get as many of their calves as possible. And it is also true in commercial herds for, in order to get the top production of milk from a herd, it is essential that each cow freshen annually. These examinations should be made for the purpose of determining pregnancy at an early stage or determining why pregnancy does not exist and thereby correcting the condition before the animal becomes a boarder in the herd.

Sterility is a term used to designate inability of a cow to conceive or carry and deliver, at term, a normal viable fetus, either because of an abnormal or diseased condition of the dam or of the sire.

There are many conditions that cause sterility. They may be placed in two classes: (1) *Specific,* or those that are contagious and caused by a known infection such as brucellosis, infectious granular vaginitis and trichomoniasis; (2) *Non-specific,* such as cervicitis, endometritis, mummyfied fetus, salpingitis, contracted ligaments, fibrous ovaries and cystic ovaries.

However, I believe I can simplify this discussion and make it more practical, perhaps, by discussing the pathological conditions in the order in which they are reached in making an examination of the genital tract. That is, by beginning at the external opening and following through to the ovary. In making an examination of the genital tract of a sterile cow, after eliminating brucellosis as a cause, I would expect to find one or more of the following conditions: infectious granular vaginitis, trichomoniasis, cervicitis.

Infectious Granular Vaginitis

According to Lockhart this disease is caused by a short chain streptococcus that he calls *Str. vaginitidis.* A few years ago it was definitely the most general and most prevalent cause of failure to conceive and, although in late years it seems to occur in a less virulent form, it is still the most prevalent cause of sterility in heifers. Granular vaginitis is an inappropriate name for this condition, as the greater part of the vagina is seldom visibly affected. The characteristic granular nodules are very numerous on the vulvar mucosa, but are not seen farther forward than the urethral opening, or about half the reach of a finger.

The clinical diagnosis of granular vaginitis can be made readily by simply parting the lips of the vulva and noting the many small red elevations on the mucosa near the clitoris. These vary in number and in the degree of anger. Apparently copulation aggravates the condition, to the extent of producing a purulent vaginal catarrh. When this disease is found in a severe form in a herd, usually a high percentage of the cattle, from two months to three years of age are affected. In other instances only virgin heifers are involved and occasionally only sporadic cases are noticeable. It is difficult to determine all the different modes of transmission. Since the disease shows itself in the bull by the characteristic granule on the penis and mucous membrane of the prepuce, it is reasonable to suppose that it is transmitted by the bull at the time of mating. But the fact that it is frequently found in calves and virgin heifers precludes the bull from being regarded as the sole means of the transmission. Possibly the causative organism is carried by the air, possibly also by licking.

The extent to which this condition interferes with conception depends on the degree of infection. I recall one group of 32 heifers which had an average of four services each and, on examination, only six were found to be pregnant. A conception ratio of 1:21. They had a very severe infection but eventually all conceived.

* Presented at the 17th annual meeting of the Florida State Veterinary Medical Association, St. Petersburg, Oct. 28-29, 1946.

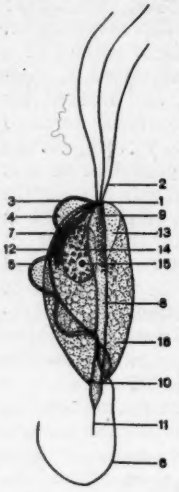
Vaginitis can be found, to some extent, in nearly every herd. There may be sporadic cases only, but they are troublemakers. In other words, it is not uncommon to find one or two animals in a herd that have been mated several times without conceiving, and with no apparent cause except an infected vagina which responds readily to treatment for vaginitis.

Treatment and Control.—In severely infected herds, where groups of heifers are showing the disease, my experience has convinced me that vaccination with an autogenous bacterin is a most effective and rational method of treating. By vaccinating the entire herd, including the service bulls the infection can usually be subdued to the extent that, for a period of time, it will not interfere with conception. In mild and sporadic cases a bicarbonate of soda or saline douche from two to six hours prior to service is effective. This should be applied with sufficient force to cleanse the vagina and mouth of the cervix of any inflammatory exudate which might destroy the spermatozoa before they come in contact with the ovum. Once the animal conceives, infectious vaginitis seldom produces abortion.

Trichomoniasis

Trichomoniasis in cattle is caused by a protozoon, *Trichomonas foetus*. Perhaps, it should be considered here in as much as it causes a vaginitis in acute cases. It differs from the infectious granular type of vaginitis, in that granular elevations extend the full length of the vagina; giving the vaginal mucous membrane a rasp-like feel. This symptom is found only when uterine secretions carrying the trichomonad organisms are being discharged into the vagina. Their presence is a definite diagnostic symptom of trichomoniasis, but their absence from the vagina does not prove that Trichomonas infection is not present in the uterus. It can be present and the cervical seal be unbroken—with no discharge into the vagina.

In the late 1930's trichomoniasis was present to an alarming degree in many herds in my section. In these herds the incidence ranged from 10 to 80% in females of breeding age. However, this incidence has decreased rapidly in the past few years, until now I seldom see a case of it. I think the principal factor in its decrease has been the practice of artificial insemination. The service male was the principal means of dissemination which was largely by contact when mating was accomplished in the conventional manner, although some males carried the organism in their reproductive organs and transmitted them in the semen, even when artificial insemination was practiced. But by inseminating artificially entirely, the young males coming along were kept free from the infection—and now—in herds where this method of breeding has been practiced exclusively for some years (and very nearly all breeders are inseminating artificially), Trichomonas infection is almost a thing of the past.



Diagrammatic drawing of protozoan *Trichomonas foetus* (Riedmuller): (1) Blepharoplast; (2) anterior flagella; (3) posterior flagellum as margin of the (4) undulating membrane; (5) accessory filament in the undulating membrane; (6) posterior free flagellum; (7) costa; (8) axostyle; (9) endoaxostylar granulas in the capitulum of the axostyle; (10) chromatic ring about the axostyle at point of emergence from the body; (11) terminal spine of axostyle; (12) parabasal body; (13) cytostome; (14) nucleus; (15) caryosome; (16) undifferentiated cytoplasm. — *From Wenrich and Emmerson, 1933*

I have observed in herds where artificial insemination has been practiced for several years infectious granular vaginitis, also, is less prevalent and less virulent than previously. But it is not entirely eliminated, as is the case with trichomoniasis in most herds. It would seem that three diseases, trichomoniasis, infectious granular vaginitis and cervicitis are in large measure brought under control by the continued practice of artificial insemination.

Cervicitis

Continuing the examination of the reproductive organs of the cow, the next organ to be examined is the cervix. Inflammation of the cervix, cervicitis, is not uncommon. In some herds, it is the cause of much sterility. There may be a simple inflammation of the os, shown by redness, swelling and a purulent exudate, or the inflammation may extend the length of the cervical canal, causing a very much enlarged cervix that can be distinctly felt or outlined by palpation through the rectal wall.

In mild cases of cervicitis, douching with a slightly alkaline solution with sufficient force to cleanse the os of any inflammatory exudate a short time before breeding, is often sufficient. More severe cases require treatment at regular intervals, for a considerable period, with astringent douches of swabs such as a 1% solution of iodine, or potassium perman-

ganate. It is not uncommon to find the first or second cervical fold partially or wholly everted. In this case it is necessary, or certainly advisable, to resort to surgery. By retracting the cervix, the fold can easily and quickly be amputated with long handled, curved scissors. There is one precaution to observe: in case the entire fold is protruding and is removed there is danger of the cicatrial tissue, formed during healing of the wound, completely occluding the opening to the cervical canal. This may be prevented by dilating the cervical canal at intervals during the healing process. It is seldom, however, that a complete protrusion occurs. I have found this removal of everted cervical folds to be a very simple and beneficial operation.

Endometritis

Continuing the examination into the uterus one sometimes finds endometritis. Since there is a cleansing process of the mucous membrane of the uterus during each heat period, endometritis is seldom found in cows that have normal heat cycles. Consequently this condition of endometritis can be controlled by inducing regular heat periods. Usually this can be accomplished by manipulation of the ovary by expressing, or safer, partially expressing the corpus luteum when one is present. The presence of a cyst on the ovary also interferes with normal heat but that will be discussed when examination of the ovary is reached. Injection of stilbestrol will sometimes induce heat but I doubt if it can be depended upon to do so regularly.

Pyometra

The same method of treatment applies to pyometra, another pathological condition met with in the uterus. In extreme cases there may be many gallons of pus in the distended uterus. In such cases the uterus drops over the pelvic brim and the ovary cannot be reached. It then becomes necessary to empty the uterus by syphoning to an extent that the ovary can be reached and the corpus luteum removed. This amount of pus seldom accumulates except in cases of Trichomonas infection. It happens occasionally that one is unable to remove or partially remove the corpus luteum by reasonable pressure. More often removal is difficult at the first attempt and rather than punish the ovary severely it is better to massage it and repeat the treatment at a later date. If at the second massaging the yellow body cannot be squeezed out, without danger of injury to the ovary, the region in which the corpus luteum is imbedded should be punctured and a short incision made. This will weaken the ovarian wall enabling one to break loose the embedded corpus luteum. This operation is not difficult to perform. I use it often in cases of obstinate retention of the corpus luteum and in thick-walled cysts of the ovary. The quick recovery that a uterus, distended with an enormous amount of pus for a long period, will make when a retained corpus luteum is removed is little short of marvelous. In a big

Sometimes hemorrhage occurs following extirpation of the corpus luteum

majority of these cases, once the corpus luteum is removed, the uterus will empty and involute to normal size in a couple of weeks and the animal will conceive at an early date.

Imperforate Fallopian Tubes

Occlusion of the fallopian tubes can now be considered. The occlusion may be the result of a tubal infection and inflammation, *i.e.*, salpingitis and, I think, also from pressure by a contracted and fibrous broad ligament. This condition is often present and is discernible by palpation through the rectal wall. One can easily determine whether there is a thickening and contraction of the ligament that suspends the uterus and the extent to which it is contracted and thereby form a good idea as to the chance the animal has of conceiving. If only one side is affected, the animal still has a good chance to conceive, but it will require more than the normal number of services per pregnancy. Quite often both sides are contracted. If they are contracted more than 50%, *i.e.*, if both ligaments are less than half the normal length, my experience has been that the animal is a poor breeding prospect, but not necessarily a hopeless one. Again I say the resourcefulness of nature when it comes to reproduction is remarkable—sooner or later an ovum may get through a contorted tube to where it can be fertilized. I have learned to be very reluctant to pronounce a cow definitely a non-breeder. It is a good way to weaken or lose the confidence of one's client. Some of them are so reluctant to send a valuable cow to the butcher, that they will sometimes breed her one more time, after you condemn her—and get conception. To my cha-

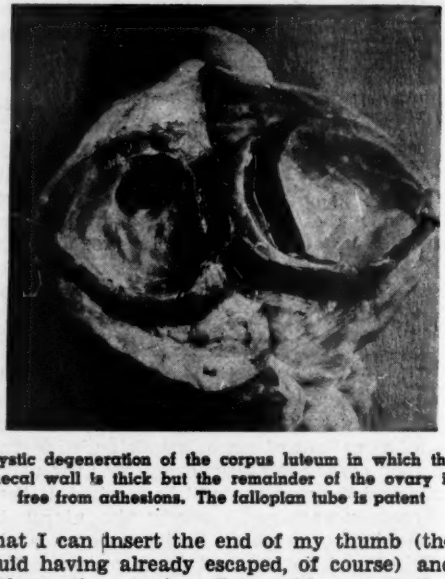
grin, I have had that happen. Occasionally, I have found thickened or contracted ligaments in heifers that have never been bred and I have found them often in heifers that have conceived and aborted in the early stages of pregnancy; an occurrence, by the way, which I believe to be more common than is generally suspected. As to treatment, there is very little that I have been able to do for occluded tubes other than wait on Nature to improve the condition. Efforts to open the tubes by air pressure have not been effective in my practice.

Cystic Ovary

The most common condition of the ovary that results in sterility is that of cysts. My records show that 5% to 8% of the cows in the herds that I attend have cystic ovaries. This percentage is rather constant through the years. As some are corrected others develop, and it is usually the better cows that develop cysts. For that reason it is one of the major as well as the most common of sterility problems in mature cows. All of you, I presume, are familiar with symptoms and characteristics assumed by a cow when her ovaries become cystic. The relaxation of the ilio-coccygeal ligament, allowing her tail head to elevate; the enlarged spongy vulva; the over development of the muscles of the shoulder and neck—sometimes to the extent that she cannot be fastened in an ordinary stanchion; the increased attention shown to other cows in heat. In short they assume various male characteristics and actions. Not all cows with cystic ovaries show all of these symptoms. Some do not show them even to a recognizable extent. There are two types of cysts—the internal or deep cyst with a very thick wall and the external or peripheral cyst with a very thin wall. It has been my observation that it is the peripheral type of cysts, which sometimes develops to the size of an orange, that causes the greatest sexual excitement.

Cows with even a very small cyst do not experience normal estrus and, consequently, will not conceive. They may have cysts in both ovaries simultaneously. When cysts in one ovary are ruptured they are prone to develop in the other. They are often multiple in the affected ovary and, if not all of them are ruptured, desirable results are not obtained. Cysts are prone to recur. Once a cow's ovaries have become cystic, she seldom recognizably recovers without treatment.

The most practical treatment of a cystic ovary is to remove the cyst by massage and rupture of the cystic membrane, and continue this at intervals until they cease forming. This is very simple and easily done in the case of the thin-walled cysts. Such cysts often collapse with very little pressure. Sometimes the deeper cysts with thicker walls can be ruptured by pressure without doing injury to the ovary, but there are many instances when this is not the case and, rather than punish the ovarian tissue by too much pressure and possibly force the fluid into the fimbria, it is much better and much more effective to make an incision in the cyst wall. This operation is simple and harmless, if done with care. I presume it could produce some damage, but in the scores of times I have used it I have yet to have any accident or see any ill-effect from it. With one hand, in which I have a curved, sharp-pointed bistoury, in the vagina and the other hand in the rectum. I pick up the ovary in the palm with the cyst side down, and using it as a backlog I puncture through the vaginal wall into the anterior portion of the cyst. Holding the bistoury steady I move the ovary forward—thereby making an incision in the cyst membrane sufficient in length



Cystic degeneration of the corpus luteum in which the thecal wall is thick but the remainder of the ovary is free from adhesions. The fallopian tube is patent

that I can insert the end of my thumb (the fluid having already escaped, of course) and enlarge the opening. Even with an opening this size it will often close and the cyst form again, unless the incision is kept open by frequent massaging. It is very essential that an animal with cystic ovaries be examined and treated frequently, if it is at all possible. If this can be done the recovery rate is almost 100%. Every time a cyst forms whether it is ruptured by pressure or surgery there is a certain amount of ovarian tissue destroyed and a certain amount of fibrous tissue forms. If this happens many times, even if and when the cysts stop forming it may be some time before the ovary begins to function normally but, again, it is surprising how Nature will correct

the condition and, in nearly every instance, the animal will eventually conceive, unless prevented by a pathological condition of some other organ or organs.

There are, of course, abnormal conditions that retard the progress of treatment. For instance, I recall a very valuable cow in which the right ovary contained a deep cyst but was adhered to the pelvic wall rather far forward by fibrous and fatty tissue. In other words it was impossible to retract the ovary far enough to reach it with a bistoury for incision. It was also impossible to rupture by pressure. However, by patient manipulation at intervals and Nature's aid, I finally was able to retract it and incise it. The left ovary, as commonly happens, became cystic immediately. However, I handled it and the prospect looked favorable for an early resumption of a normal heat cycle.

Nonfunctional Ovary

The next and last organ of the genital tract of the cow to be considered is the ovary. There is one condition of the ovaries that enters into the problem of sterility which I do not consider as pathological, but rather as nutritional or functional. That is the small, dormant ovary. Heifers sometimes will fail to develop heat periods until months after they are old enough to breed. Cows with malnutrition fail to come into heat for long periods. The ovaries fail to function. I have observed it in apparently fairly well nourished animals. Of course a sufficient quantity of a well balanced ration is indicated to correct this condition. Massaging of the ovaries, applying sufficient pressure to bring about a stimulation of the circulation of blood in the ovary is beneficial. This may need to be repeated. Stilbestrol injections are indicated.

Retained Corpus Luteum

There are other ovarian conditions that also interfere with the normal heat cycle. A deeply imbedded, so-called retained, corpus luteum will prevent estrus. If this is the trouble, the condition can be remedied by removing or partially removing it in the manner already described in the discussion of pyometra. In doing this there is only slight danger of a fatal hemorrhage, but there can be enough hemorrhage in the tissue surrounding the ovary and ligament to produce a hematoma and cause adhesions of the ovary and ligament and thereby interfere with conception later on. It is safer to loosen the yellow body slightly then, a few days later if the animal has not come in heat, it can be removed safely by further manipulation. Occasionally it is necessary to make an incision in the ovarian capsule—an operation which I have just described. Sometimes stilbestrol injections aid but they are far from being specific.

Mummification of the Fetus

There is another very disconcerting condition that enters into the problem of sterility of cattle. It is found rather commonly and presents quite a problem. I refer to mummification of the fetus. This occurs in nearly all the herds that have been under my observation to an annual extent of about 5% of the breeding females. Some herds have a higher percentage of heifers and cows that develop mummies, the fetus dying, usually between the fourth and sixth month of pregnancy. Occasionally the fetus is expelled without treatment and without the knowledge of the owner or attendant. This can happen due to the fact that all the amniotic fluid has been reabsorbed —even the body fluids of the fetus. The membranes are usually expelled with the fetus, with no discharge following. The animal usually comes in heat within a very few days.

There is evidently some disturbance in the production of the hormone that serves to retain the corpus luteum in the ovary or maybe there is interference with the blood supply to the fetus. There is a very interesting phase to this occurrence. I have not seen it mentioned in literature but, very definitely, the condition of mummification in cattle is a family weakness. I have records, kept through many years that show that this has occurred in cow families consecutively for generations. I have observed more than a dozen cow families where this has occurred in as many as four generations, and many more families in two and three generations. The heritable factor, whatever it may be, seems to be sex linked—transmitted only in the female line. Not all pregnancies, of course, terminate in mummies or the family would ultimately come to an end, which probably would be fortunate for the breeder as well as the breed since about every second conception results in a mummified fetus, thus unduly prolonging the interval between calvings. Females in families carrying this taint are a liability rather than an asset.

Some breeders are beginning to recognize that mummification is heritable and are taking steps to terminate the families that carry the gene for it. They are being terminated through the butcher route, for it is considered unscrupulous to offer a female of one of these families for sale for breeding purposes.

As I have often stated before, I believe the veterinarian should make an effort to educate breeders to the advantage of a regular and systematic examination of the herd in order that they may be able to detect and correct abnormal conditions in the early stages. Your client will soon learn to appreciate this service for, to him, it is one of the most profitable services that you can render.

Neoplasms of Animals; Their Clinical Importance and Treatment*

By Carl F. Schlotthauer†

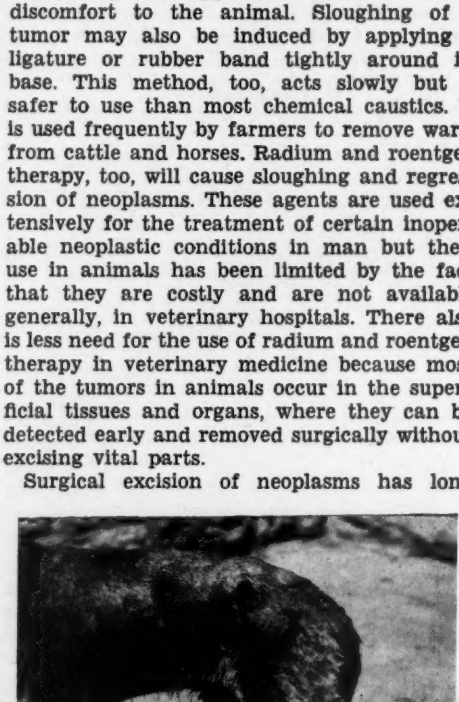
Division of Experimental Medicine, Mayo Foundation, Rochester, Minnesota

NEOPLASTIC diseases are of frequent occurrence in animals but their clinical importance is as yet not recognized generally. Most persons other than veterinarians still commonly think of neoplastic diseases only as ailments of man. Because of this general lack of knowledge concerning these diseases, each year many animals are disabled and die or are subjected to euthanasia because of neoplasms which could, in many instances, be treated successfully if the condition were recognized early. I propose to call attention again to the importance of these diseases and to discuss their treatment briefly.

A review of the literature dealing with neoplastic diseases in animals reveals that the same histologic types of neoplasm develop in animals as in man. They differ only in their incidence in certain sites. Neoplastic disease of the gastro-intestinal tract and central nervous system is fairly common in man, but is rarely encountered in animals. The skin and external organs are the most frequent sites of neoplasms in animals. There also is a marked difference in the frequency and location of neoplasms among the different species. Among domesticated animals neoplasms occur most frequently in dogs, horses and chickens. The dog is subject to nearly all of the various neoplasms observed in man and the bitch is the only animal in which neoplastic disease of the mammary gland is a common ailment. Melanotic tumors are common in gray horses; tumors of the testes are frequent in old dogs and neoplastic disease of the blood-forming organs (leukosis) is common in chickens. These are only some of the instances one can cite to illustrate the variation in susceptibility of certain species and tissues for the development of neoplasms.

The treatment of these neoplastic diseases of animals has been and still is varied. To be satisfactory a treatment must be economical, generally available and cosmetic as well as curative. The cosmetic effect in some instances is more important than the curative effect. Such an instance can be illustrated by an old dog which has an unsightly external tumor and metastatic tumors internally. Excision of the external tumor will not cure the condition, but it will make the animal more comfortable, improve its appearance and prolong its usefulness, which is all that one can hope for in the cases in which cure is effected. Removal of a tumor may be accomplished by various methods. Certain chemical agents which kill tissues have been used to cause tumors to slough. However, they usually act slowly, may require repeated application and often cause discomfort to the animal. Sloughing of a tumor may also be induced by applying a ligature or rubber band tightly around its base. This method, too, acts slowly but is safer to use than most chemical caustics. It is used frequently by farmers to remove warts from cattle and horses. Radium and roentgen therapy, too, will cause sloughing and regression of neoplasms. These agents are used extensively for the treatment of certain inoperable neoplastic conditions in man but their use in animals has been limited by the fact that they are costly and are not available generally, in veterinary hospitals. There also is less need for the use of radium and roentgen therapy in veterinary medicine because most of the tumors in animals occur in the superficial tissues and organs, where they can be detected early and removed surgically without excising vital parts.

Surgical excision of neoplasms has long been a common method of treating neoplastic diseases in both man and animals. It is rapid in its effect, humane, and when applied early is highly curative. Use of this method of treatment is limited only by the site and extent of



Surgical excision of neoplasms when applied early is highly curative

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the neoplastic process and the physical condition of the animal. When a neoplasm is so situated or is so extensive that it cannot be excised, or the animal is in too poor condition to withstand an operation, one should use other methods of treatment or advise euthanasia. The effectiveness of surgical excision of a neoplasm depends almost entirely on the histologic character of the growth and the amount of tissue which is removed.

Benign tumors do not infiltrate the tissues or organs in which they are situated nor do they metastasize, whereas malignant tumors commonly infiltrate and destroy the tissues or organs in which they are situated and some will metastasize widely. Therefore, simple excision of a benign tumor is, in most instances, sufficient to cure the condition, but to treat a malignant neoplasm effectively one must excise the tumor-bearing tissue as well as the tumor, because merely to excise the neoplasm and leave that portion of skin or the organ in which it was situated would only invite recurrence of the condition. It always is better to remove more tissue than is necessary than to be too conservative and not take enough. Since carcinomas commonly metastasize through the lymph vessels, one should, when dealing with them, simultaneously excise the adjacent lymph nodes with the neoplastic mass. This is not always possible but when it is done it tends to block or prevent metastasis and recurrence of the neoplastic condition.

Carcinomas and sarcomas, too, frequently invade the blood vessels within the neoplastic mass. When that occurs masses of cells sometimes break away and metastasize through the blood stream. Because of this tendency of malignant neoplasms it is important that they be handled gently and not be incised during the operative procedure. Rough handling or cutting into a neoplasm while it is being excised may free bits of tumor tissue or neoplastic cells and cause them to become implanted in the wound or metastasize to other parts. But even when operated upon early, and an amount of tissues which is seemingly adequate is removed with the tumor, some failures occur because highly malignant neoplasms sometimes metastasize very early.

Certain mammary tumors in the bitch will regress following oophorectomy. This operation has been used by some veterinarians in the treatment of these tumors. But it must be used with caution and discretion because oophorectomy will not inhibit growth or prevent metastasis of a highly malignant neoplasm, nor will it remove an unsightly cartilaginous or osseous tumor.

This discussion has dealt very briefly with some of the more important factors that have to do with the surgical treatment of neoplasms. The following discussion briefly describes my surgical methods of treating tumors of the skin, mammary glands, testes, mouth and eyes in animals.

1. Tumors arising from, or situated in, the skin

A wide variety of tumors are encountered in the skin of animals. They vary from small epitheliomas and fibrous warts to large fibromatous, carcinomatous and sarcomatous masses. The benign tumors are encountered most frequently but malignant neoplasms are fairly common. Since in many instances one cannot differentiate them clinically, it has long been my policy to treat all tumors as malignant until they have been proved otherwise by microscopic study. I therefore commonly excise the tumor-bearing portion of skin simultaneously with the tumor. When this is done, the incidence of recurrence and metastasis is reduced to a minimum. The surgical incision in all instances is closed with a suture and is treated as any other skin wound. Small tumors such as warts sometimes are removed by thermocautery. This means of removing a small benign tumor is simple and can be done rapidly with a minimum of surgical preparation and equipment. The wound in this instance is not sutured.

2. Tumors of the mammary glands

The bitch is the only animal in which neoplastic disease of the mammary glands is a common ailment and discussion of this condition in animals will deal only with its surgical treatment in dogs.

A wide variety of neoplasms have been observed in the mammary glands of the bitch. Most of them are carcinomas but other histologic types are fairly common. In a series of 135 mammary tumors from dogs collected and studied by J. A. S. Millar and the writer, 105 (78%) were carcinomas. Of these, 59 were classified as mixed tumors, 43 were adenocarcinomas and three were squamous cell carcinomas. Among the 30 other tumors in this series three were highly malignant sarcomas which metastasized and 27 were benign growths.

The mixed tumors occurring in the mammary gland are carcinomas which contain more than one neoplastic tissue element. They commonly are considered to be less malignant than the simple adenocarcinomas but one cannot rely upon this because fairly frequently one or more of the neoplastic tissue elements in a mixed tumor may become highly active and metastasize. This occurred in nine instances among the 59 mixed tumors studied by Millar and me. It is possible, too, that the

three sarcomas which metastasized began as mixed tumors.

Highly malignant adenocarcinomas commonly metastasize. Metastasis was observed in 40% of those studied by Millar and me.

Since such a large portion of the mammary tumors in dogs are carcinomas, I commonly treat them all as such. The method of surgical treatment used at present is one that was developed by Stalker and the writer in 1936. Prior to that there was no standardized operative procedure described in the literature and one could only guess as to how much tissue or what glands to remove when excising a mammary tumor of a bitch. We studied the lymphatic drainage of the mammary glands and found that in bitches that have five glands or nipples on each side, the lymph from the two anterior or thoracic glands on each side, which we designated as gland 1 and gland 2 from before backward, always drains anteriorly into the axillary lymph nodes. The lymph from gland 2 also commonly drains into or through the lymphatics of gland 1. The lymph from the anterior abdominal mammary gland, which we designated as gland 3, commonly drains by a separate lymph channel directly into the axillary lymph nodes but in some instances it also drains into the lymphatics of the second and first mammary glands, and from them into the axillary lymph nodes. We were unable to demonstrate that lymph from gland 3 ever drains posteriorly, but it may do so in some individuals. Lymph from the two posterior mammary glands, which we designated as gland 4 and gland 5, always drains posteriorly into the inguinal lymph nodes. The lymph from gland 4 usually drains into and through the lymphatics of gland 5, and thence into the inguinal lymph nodes.

After learning the route of drainage of the lymph from the mammary glands we developed the following operative procedure: When a neoplasm is present in the first or second mammary gland both of these glands on the affected side should be removed because they usually are confluent. When a neoplasm is present in gland 3 and is so small that it does not extend posteriorly into the region drained by the lymph vessels of gland 4, it is necessary to remove only glands 1, 2 and 3; glands 4 and 5 need not be removed unless the neoplastic mass has extended posteriorly so that lymph from it may drain posteriorly. But if the tumor

Doctor Schlotthauer operating on a German police dog at the A.V.M.A. clinic in Omaha, August, 1937

in gland 3 is large, it would seem advisable to remove all of the mammary glands on the affected side. When either of the two posterior glands (4 and 5) is the seat of neoplastic disease, both should be removed because these glands, too, usually are confluent. Since the inguinal lymph nodes are readily accessible they should be removed simultaneously with glands 4 and 5 when the latter are being excised. With this operative procedure there is a minimum of recurrences and metastasis.

In some instances, when a bitch is not too aged and is in good physical condition, I perform oophorectomy simultaneously with the resection of the mammary tumor. This tends to cause the remaining mammary glands to atrophy and inhibits or prevents the occurrence of neoplasms in them. Oophorectomy alone will cause regression of some mammary tumors. I have employed it in instances in which the neoplastic mass was too large to be excised safely. But the results have not been entirely encouraging. I still prefer excision of the tumor and the affected gland in those cases in which it can be done. Recurrence of mammary neoplasms can also be prevented by complete excision of the mammary glands. This removes the tissues which give origin to the tumors. I do this in young bitches which have mixed tumors in one or more of their mammary glands when the owner will not permit spaying.

3. Tumors of the testes

Tumors of the testes are frequent in dogs past six years of age. Various histologic types of neoplasms have been encountered in the testes of dogs. Most of the benign tumors are interstitial cell adenomas. The malignant tumors usually are seminoma type carcinomas. The interstitial cell adenomas are relatively frequent in aged dogs and rarely become large enough to be noticeable in the living animal. They usually are found on necropsy. But the carcinomas, although more frequent in old than in young dogs, may occur at any age. They often become quite large and noticeable in the living animal and some of them metastasize to other organs.

Surgical removal of the affected testis, if it is done early, usually is curative. I use this method of treatment regardless of the histologic type of the neoplasm which is present. If the tumor is not too large the testis is removed through an incision made in the inguinal region 2 to 4cm anterior to the scrotum. The advantage of this site for making the incision is that it may be closed with sutures. If the tumor in the testis is large it must be removed through an incision in the scrotum. But because of the pendulous character of the scrotum an incision in it had best be left open.

4. Tumors occurring in the mouth

Infectious warts or papillomas of the mouth are of frequent occurrence in dogs but their treatment will not be discussed. Among the other tumors of the mouth which I have treated surgically are fibromas, epulises, epitheliomas, fibrosarcomas and melano-epitheliomas. Surgical excision of a fibroma or an epulis usually is curative, but when malignant tumors in the mouth are excised recurrence is fairly frequent. This is due to the fact that one cannot always remove an adequate amount of tissue and unless the tumor-bearing tissue as well as the entire neoplasm is removed the treatment is not effective.

5. Tumors occurring in the eyes or the eyelids

Various tumors occur in the eyes or the eyelids of animals. Among dogs epitheliomas are fairly frequently encountered on the eyelids. Their treatment is similar to that of tumors occurring in the skin in other places but when they occur at the margin of the eyelid, one sometimes cannot, without causing deformity of the eyelid, remove an adequate amount of tissue to be assured that there will not be a recurrence of the condition. If the deformity is so great that it cannot be corrected or repaired by subsequent plastic surgical procedures, it usually is more desirable to remove the entire eye and eyelids. Fortunately this is not so frequent in dogs as in other animals.

When enucleating the eyeball I like to use the technic demonstrated to me by Hermann of Denver. It is as follows: After the eyeball has been freed from the eyelids it is grasped with a pair of pronged forceps and is rotated or twisted until the muscles and vessels are severed by torsion. When this method of enucleation of an eyeball is used there is little or no hemorrhage and ligation of the optic artery can be safely omitted. There is rapid healing and a minimum of discomfort is experienced by the animal because sloughing ligatures and packs are not present in the orbit.

Neoplasms occurring in other organs or parts of the body are treated in a manner similar to that which has been discussed. In all instances it is the aim and purpose of the treatment to preserve the life of the affected animal, make it more comfortable and restore its usefulness. The treatment used should therefore be both curative and plastic in its effect. And, too, since some farm animals are maintained for their economic value rather than sentimental reasons, treatment must in these instances be economical. Surgical excision of neoplasms, when it is done early and an adequate amount of tissue is removed, closely approaches the requirements mentioned.

Canine Spirochetosis*

By H. C. Smith
Sioux City, Iowa

CURRENT medical literature contains many discussions of Weil's disease, spirochetal jaundice, canicola fever or leptospirosis icterohemorrhagica. The extent of this spirochete infection in man in this country and its prevalence in the territory where it is endemic will not be known until further public health reports on it are published.

The extent of the disease in man is important to veterinarians since the organism that causes this disease in man is morphologically as well as biologically the same as that which causes a similar disease in dogs, cats and foxes. Krumbein and Frieling have found dogs affected with the disease living in association with human sufferers. Inada and Ido, two Japanese investigators, isolated the organism from man. At the 12th International Veterinary Congress, Klarenbeek of the Netherlands gave a detailed report of the disease as it occurs in dogs. Catachpole, Laidlaw, Dunkin and Rubrath report the disease as occurring in both wild red and domesticated silver foxes.

Although probably most veterinarians engaged in small animal practice have suspected certain cases of being spirochetosis or leptospirosis, there have been few reports of the occurrence of the disease in animals in this country. Leptospira were isolated from a dog at the Connecticut experiment station and reported by Jungherr. Meyer[1] and associates of the George Williams Hooper Foundation, San Francisco, published an extensive article on leptospirosis in dogs in 1939. This is the most valuable and uptodate research on the subject as yet reported. Later, Elander and Perry of San Diego, California, who had worked with Doctor Meyer and supplied him with material such as dog's blood and urine for agglutination tests, reported six cases that had occurred in their practice.

Our own experience in the laboratory at Sioux City leads us to believe the disease is rather wide spread, at least in the north central states. Apparently the great difficulty of differentiating leptospirosis, clinically, from other more common diseases of the dog and the rather cumbersome laboratory methods of making a definite diagnosis in this disease is the reason why it has not been reported more often.

Our own experience with this disease in the field and in the laboratory has been in many instances very discouraging. The spirochete is most difficult to grow on artificial media, and a large number of guinea pigs are required to keep it alive and going in series.

Susceptibility

All ages and breeds of dogs are susceptible to leptospirosis. The young are more susceptible than the aged. There is a tendency for the disease to occur more frequently in the hunting or sporting breeds, probably because of the greater exposure of dogs of this type.

Mortality Rate

The mortality rate varies depending on the virulence of the organism and the susceptibility of the dogs—age being one of the determining factors. It ranges from 6 to 95%. Death is usually attributed to terminal bronchial pneumonia or to toxemia due to liver destruction or to nephritis.

Etiology

Two species of Leptospira, *L. canicola* and *L. icterohaemorrhagiae* cause spirochetosis in dogs. The Leptospira is a cylindrical, wavy or spiral microbe, the ends of which are thin and pointed but not flagellated. There are many spirochetes, some multiply by transverse and others by longitudinal division. Some are pathogenic, more are non-pathogenic. Some may be cultivated easily in artificial media; others, can be grown only with great difficulty—due, no doubt, to their very fragile structure.

Young dogs are more susceptible to the disease than the aged

The most common pathogenic spirochete encountered in the human family is the *Tre-*

*Presented at the 17th annual meeting of the Florida Veterinary Medical Association, St. Petersburg, Oct. 28-29, 1946.

[1] Meyer, K. F., Stewart-Anderson, B., and Eddie, B. Canine leptospirosis in the United States, *J. A. V. M. A.*, 95:752, pp. 710-729. 1939.

ponema pallidum (Spirochaeta pallida). Other pathogenic spirochetes are: *Spirochaeta bronchialis*, which causes, in man, a severe hemorrhagic bronchitis marked by distressing cough. The *S. forans* producing a urethritis, conjunctivitis and later arthritis in that order; *S. theileri* causing fever, diarrhea and splenauxe in cattle; *S. anserina* occasioning a fatal wasting diarrhea in geese and *S. gallinarum (Borrelia gallinarum)* causing tick-bite fever in fowl.

Growth of the Organism on Cultures

The virulence of *L. icterohaemorrhagiae* and *L. canicola* is maintained by passage through guinea pigs. It is peculiar in that they may live in tap water exposed to cold weather for many days, but often die under favorable conditions without reason. Blood agar and gelatin, human serum, diluted ox serum and ascitic fluid, all may be used for culture media for these spirochetes. Growth occurs, as a rule, in from three to seven days at 30° C. on the first generation which may live from three to six weeks. Usually, however, the culture is dead at the end of the third week. Growth is at its height about the 10th day in primary cultures and at the 4th to the 6th day in subsequent subcultures. In the presence of contamination or secondary infections there is a very feeble growth or none at all.

Tissue Inoculum

The inoculum should be emulsions of ground kidneys or pieces of liver from an infected dog. This may be inoculated into culture media or intraperitoneally into guinea pigs. Repeated passages of Leptospira through the guinea pig increases their virulence. Death of the pig usually occurs on the 10th or 11th day. Lesions show extensive hemorrhages on the abdominal viscera and lungs. General icterus may be rare in the guinea pig. Careful observation of the inoculated animal may show some dysuria. This is very indicative of spirochetosis. The urine is dark and extremely yellow.

Urine As an Inoculum

The spirochetes appear in the urine with the onset of the jaundice and are very numerous at this stage, which is reached about the 9th day. Excretion of the organisms attains a maximum about the 15th day, after which they disappear from the urine rather rapidly and are usually all gone by the end of the 5th week. Urine may be obtained by catheterization and inoculated, intraperitoneally, into guinea pigs. If the guinea pig dies in from one to five days a diagnosis of infection due to bacteria should be made. Should the guinea pig die on the 10th or 11th day, one is rather safe in making a diagnosis, then, of leptospirosis.

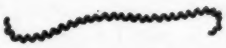
Blood As an Inoculum

In dogs the blood is infectious only early in an attack of leptospirosis. The spirochetes appear in the blood with the onset of the fever, before the jaundice appears. Therefore, to use blood as a means of diagnosis, the guinea pig inoculations should be made at the height of the temperature curve, which is usually before the 4th day of clinical illness.

Symptoms

The clinical manifestations associated with Weil's disease or leptospirosis, are not always easy to differentiate from better known conditions frequently seen in dogs. In fact, it is often impossible, without a bacteriological or serological diagnosis, to differentiate this disease from distemper, uremia, tonsilitis, and catarrhal jaundice.

The first phase of leptospirosis is the febrile stage—the temperature reaching as high as 108° F. It is ushered in by chills, fever, thirst, conjunctivitis, vomiting, diarrhea, nasal hemorrhage and anorexia. Urine tests show traces of albumen and the lifting of the dog appears to cause it pain. Nephritis is present and the usual ulceration of the gums may be in evidence. The Leptospira are present in the blood stream at this stage of the malady.



Leptospira

Leptospira, genus of the order of Spirochaetales of the family Spirochaetaceae, are thin spiral organisms, flagellated at the extremities, one or both of which are bent back like a hook. *L. canicola* causes an infection in dogs which is transmissible to man. *L. icterohaemorrhagiae* is responsible for Weil's disease in man and is transmissible to dogs

The second phase is the icteric stage. The jaundice shown in the sclera appears about the 4th to the 10th day after the onset of the disease. Some cases do not show icterus. The dog is restless—does not want to lie in the same place for any length of time—scratches himself for no apparent reason and, if examined closely, small bright red hemorrhages may be discovered on the light areas of the skin. These hemorrhages resemble those of scarlet fever. When pressed with the finger they disappear—but only for a short time. At this stage the leptospira are present in the liver, kidneys, spleen and urine and death usually occurs.

If death does not occur during the icterus the dog goes into the third or convalescent stage. The animal ceases vomiting, begins to eat sparingly of solid food, drinks water at regular intervals and in much smaller amounts. The jaundice clears up.

The rate of recovery is inversely proportional to the destruction of kidney tissue. The

organism may be voided in the urine even after apparent recovery; hence dogs remain carriers for an unknown period but, at least, six weeks.

Methods of Detection of Leptospira

1. Examination of stained blood films.

A very simple yet effective stain to detect spirochetes in blood samples or samples of centrifuged urine, consists of the following:

Distilled water 50cc
Sodium bicarbonate .....2 drops
Methyl alcohol 1.5cc
Giemsa stain (stock solution).....1.25cc

Either citrated or whole blood, taken from a dog on the 4th to 7th day in the course of the disease, stained and examined under dark field should reveal the organisms.

Immerse the slide into the stain for eight to twelve hours. The Leptospira appear as reddish-violet-white cells. Tissue cells are stained a deep blue.

In this disease, according to Romanowski, the leucocytes of the blood stained with silver or lenodite are found to be 90% neutrophil granulocytes and 10% lymphocytes.

2. Injection of blood or urine intraperitoneally into guinea pigs should result in death in 10 days if Leptospira are present.

Diagnosis

1. A definite diagnosis depends upon finding the organism in the urine or tissues of the suspected animal. Artificial cultivation requires a special medium and laboratory facilities. Diagnosis is made by direct microscopic examination of the blood or specimens of centrifuged urine. An easier method is to make an agglutination test of the blood serum of the suspected animal, but this is unsatisfactory because immune bodies are not present in the blood until about three weeks after the onset of the disease. By that time, the dog either will be dead or on the road to recovery.

2. The blood sedimentation rate is an aid in making a diagnosis as it is very rapid in cases of leptospirosis. If white guinea pigs are available, it is advisable to make intraperitoneal inoculations, using both blood and urine. However, one should not be discouraged from failure in a single attempt to reproduce this disease. Nor should one place too much emphasis on the jaundice. It may not be present; in fact, in dogs, icterus is said to occur in only about 50% of the cases.

3. In searching the dark field, preparations for spirochetes after an intraperitoneal inoculation of white mice, it was often observed that, for the first hour after a drop of blood was placed on the slide, no spirochetes could be found; afterward, they would then begin to appear shooting to and fro among the red cells.

Transmission of Leptospirosis

Very little is known about the transmission of leptospirosis. At present it is thought that the disease is usually communicated to both man and the dog by ingestion of food or water contaminated by the urine of rats, for these animals are known to be normal carriers of both the icterohemorrhagiae and the canicola. Therefore, rat bites may also serve as a channel of infection of the dog, cat or fox. Drinking water from stagnant pools or where sewage has been deposited is also a source of contamination. Feeding at garbage dumps is believed to be a common source of infection in dogs.

Meyer has shown that dogs are capable of transmitting the disease from one another by contact, perhaps from their droppings and urine. He was able to infect dogs, artificially, by injecting the organism intraperitoneally, intramuscularly and intravenously both with infected organs and suspensions of the organisms. Wirth, in his experiments, preferred young puppies for experimental inoculation and was very successful in transmitting the disease both by injecting the organism and by feeding contaminated material.

Cause of the Icterus

As in the case of Weil's disease, there is considerable damage to the red blood cells in canine spirochetosis. This results in anemia. The spirochetes produce a parenchymal inflammation of the liver cells. This causes a hemolysis of the red blood cells, releasing free hemoglobin in the blood vascular system, which manifests itself as icterus.

We should not be misled by the icterus since this may result also from chronic infectious disease, faulty feeding, parasitism and even chemical poisons. Therefore, although icterus is a symptom of spirochetosis, it is not a pathognomonic symptom.

Causes of Ulcerations on the Gums

S. Bliss of New Orleans, in the *Journal of Biochemistry*, attempts to explain the reason for sore mouth in nephritis. In his view, the severe ulceration of the cheeks and tongue which are commonly seen in nephritic patients and nephrectomized dogs, may be due to local irritation by ammonia. The tartar on the teeth of dogs contains urease. He is of the opinion that ammonia is formed by the action of urease on the urea, which is eliminated in the saliva when there is dysfunction of the kidney. Dogs with normal blood, non-protein nitrogen values (10-20mg) do not have ulceration of the tongue and cheeks even though the teeth are coated with tartar. The ulceration of the cheeks and tongues on nephrectomized dogs is in those locations where the tissue lie against the teeth. Ulcerations clear

up when the tartar is removed from the teeth, even though the blood, nonprotein nitrogen remains elevated. Tartar scraped from the teeth of normal and nephritic dogs hydrolyzes urea solutions to ammonia in a few minutes, just as does urease. It was demonstrated that ammonia does actually damage such tissues.

Prevalence of Agglutinins

In a survey of leptospirosis made by M. R. Greene, the blood of one-fifth of the dogs selected at random in southern California contained agglutinins for *L. canicola*. Animals in veterinary hospitals showed a higher incidence. The rate in the combined group of 368 dogs was 29%. No immune bodies against the canicola species were found in the sera from one hundred cats or in specimens from 426 persons. Antibodies reacting with *L. icterohaemorrhagiae* antigen in sera from the dogs was adjudged to be due to cross reactions resulting from infections with the *L. canicola*. The sera from one cat and three persons reacted to the *L. icterohaemorrhagiae* antigen.

Leptospiral Nephritis in Man

Stiles (*J. Am. Med. Assn.*, 8/17/46), *et al*, draw some definite conclusions from human cases of leptospiral nephritis that have come under their observation.

They state: "Leptospiral infections are seldom considered in the differential diagnosis of an acute febrile illness in the absence of jaundice." Several forms of the infection are described in which jaundice is lacking. Of the primary renal or nephritic type, they say: "While this type of the disease has been recognized abroad, very few cases have been diagnosed in this country." Evidence of damage to the kidneys is an important manifestation of all types of leptospiral infections although symptoms may suggest other conditions.

The excreta of most infected rats contains the organisms, although they show no evidence of disease other than the renal infection. Since the prevention of leptospirosis in dogs is intimately hooked up with rat control, veterinarians should stress the importance of this measure. Rat control is equally important in the control of leptospirosis in man.

Leptospiral nephritis, without jaundice, which resulted in uremia and death, has been produced experimentally in dogs. The "shedder state"—that is when the organisms are excreted in the urine, in dogs, may persist for a matter of weeks but in rats which are, probably, chronic carriers, for a much longer time. The agglutination test, using urine instead of blood, may be positive during the first week.

Since the spirochetes are destroyed by acid media, our attempts at treatment should include measures to increase the acidity of the urine; thus eliminating the carrier or shedder state. A ketogenic diet (one forming acetone) may be employed against the urinary infection. Such treatment is a sanitary as well as a therapeutic measure.

Treatment

Penicillin has proved effective against the spirochetes causing leptospirosis in dogs. The dosage must be adequate and should be given at four-hour intervals. Research at the Mayo Clinic in which guinea pigs were inoculated with *L. icterohaemorrhagiae* showed that test animals survived when given penicillin 17 to 72 hours after infection. If giving penicillin was delayed until symptoms appeared, a majority of the test animals died; if delayed until jaundice appeared, none survived.

In our experimental work we injected 100,000 units of penicillin in an oil emulsion every six hours with apparently satisfactory results if the animals were treated early. Injections of penicillin are sometimes painful. This may be corrected by incorporating a small amount of a 2% solution of procaine with the penicillin solution. This prevents the pain.

The action of penicillin may be prolonged by adding 100,000 units to 1.4cc of saline solution and 3.1cc of the following:

Lanolin (Falba oil) ..... 11 parts
Peanut oil ..... 50 parts

Some work has been done using beeswax and peanut oil mixtures with penicillin. When so used, penicillin adsorption was delayed and the blood level maintained for six to eight hours. No pain was noted at the site of injection.

In research at the University of California, the duration of bacteriostatic concentration of penicillin in the blood of dogs was prolonged by using a 5% dextrose solution as a vehicle for intramuscular injections.

Penicillin added to ice cream and fed to dogs has been practiced successfully.

Specific Leptospira antiserum has been used and is effective in the early stages of attacks of leptospirosis.

Supportive treatment of salines and glucose are almost always indicated. Large doses of either calcium lactate or calcium gluconate to maintain the calcium reserve should be administered. Blood transfusions are necessary to combat the anemia.

In cases that are hospitalized, extra care should be given to cleaning and disinfecting cages, feeding utensils, paraphernalia, etc. It is advisable to keep the dog in strict isolation for some time after complete recovery is apparent because of the long, but as yet unknown, period during which recovered animals eliminate the spirochaetes in the urine. We know little of the danger of carriers other than that they exist and are a menace to other animals and man.

Dr. J. E. Greene giving dextrose solution intravenously in a case of spirochetosis for its supportive effect

Summary

1. Spirocheteal jaundice is widespread in this country. It is caused by *Leptospira icterohaemorrhagiae* and *L. canicola.*

2. Spirochetosis affects dogs, cats and foxes and is transmissible from these animals to man. The principal reservoir of the infection for both man and animals is the rat.

3. In the acute stages, spirochetosis appears as an acute hemorrhagic gastroenteritis, ending in sudden death. The earliest diagnostic symptom is a hemoptysis and a purplish rash on non-pigmented areas of the skin.

4. The cardinal symptoms of spirochetosis are loss of appetite, fever, vomiting, pain evinced when picked up, shivering, great depression, rapid dehydration, bleeding from the nose, gums, anus and eyes, and subcutaneous hemorrhage.

5. Canine spirochetosis is infectious and contagious. It affects middle-age to older dogs more commonly than younger animals; probably because puppies are less exposed than older animals.

6. Jaundice appears in only about 50% of the cases. It appears from the 4th to 7th day and reaches its height at the 10th to 12th day.

7. The central nervous system is not involved in canine spirochetosis, although twitching of the muscles sometimes occurs and also convulsions in some cases, probably due to toxemia.

8. Animals that have recovered from an attack of spirochetosis are definitely immune to reinfection. This immunity may last up to at least five to six years. Agglutinins appear in the blood about the third week in the course of the disease and are persistent thereafter.

Early Experiences with Penicillin

By the time of the invasion of Normandy the much greater supplies of penicillin available permitted its widespread employment as a prophylactic agent. As a result at least nine out of 10 wounds were clinically clean when they were first examined at base hospital level, and secondary closures became the commonest operations performed. They were carried out regularly and with impunity not only on clean wounds but on many which, in pre-penicillin days, would have been regarded as quite unsuitable for suture. This notable advance conferred untold benefits in the prevention of pain, in providing better functional and cosmetic results, in avoiding prolonged suppuration with consequent visceral damage, and in shortening convalescence. As Porritt, Debenham, and Ross (1945) commented: "The results achieved led to a saving of man-power, a reduction in wound complications, and an economy in hospitalization, in supplies of drugs and equipment, in surgeons' and nurses' time which it is quite impossible either to compute or to appreciate fully."—*British Med. J.*

* * * *

Antivivisectionists Employ Spurious Arguments

One of the fallacious arguments made by antivivisectionists is that nothing of benefit has come from animal experimentation. Let the record speak for itself.

Twenty-five years ago diabetes was a sentence of death. When a baby got this disease, its life could be measured in days. Then that pair of medical immortals, the late Sir Frederick Banting and Dr. Charles Best, found how to extract insulin from the pancreas of slaughter house animals. Millions of diabetics are alive today only because of this work, which cost the lives of 30 dogs.

Without the aid of dogs, Dr. George H. Whipple would never have been able to work out the liver extract treatment for pernicious anemia. He painlessly bled a number of dogs until they were anemic—then sought and found the magic fraction in liver which would keep them alive. Until this piece of work was done, this disease was universally fatal.

But for animal experimentation—conducted mostly on mice—we could never have had the sulfa drugs. The same is true of penicillin and that brilliant newcomer, streptomycin. At the turn of the century 60,000 babies were strangled to death each year in the United States by diphtheria. Then animal experimentation led to diphtheria antitoxin, and the ghastly slaughter stopped.—*Norman Kirk*, Surgeon General, U.S.A., quoted from *Hygeia.*

Cattle Fever Ticks in Florida*

By J. J. VARA
Bonifay, Florida

THE State Livestock Sanitary Board, attended the annual meeting of the Florida State Cattlemen's Association at Clewiston, Florida, December 11, 1945, and had presented to it for classification, specimens of ticks removed from a purebred Angus bull owned by Mr. Zibe Williams of Okeechobee, Florida. This bull had died from unknown causes on or about December 8, 1945.

These ticks were classified as cattle fever ticks and the Board immediately notified the U. S. Bureau of Animal Industry. Because of the location of Mr. Williams' cattle pastures, Highlands, Glades and Okeechobee counties were placed under quarantine immediately.

The federal Bureau of Animal Industry promptly assigned two experienced supervisors to the area to extend their usual cooperation in the tick eradication program. At the time, neither the Bureau nor the State had any appropriations for this work.

It was first necessary to determine the extent of the reinfestation, the number of old dipping vats available, their condition and the number of new vats needed. In the original tick eradication program in these counties, about 1932 and 1933, the cattle were driven out of most of this reinfested area, but now that is not practicable as the area is divided by fences and canals into numerous pastures with the result that it has been necessary for the Board to construct about 46 new dipping vats in each of the three counties.

It was also necessary to establish quarantine stations on all the main roads leading out of the reinfested area, at which points all traffic could be stopped and inspections made to prevent any material that might carry ticks from moving into free areas.

It was early determined that cattle fever ticks had existed in certain pastures of this area for at least two years and from these pastures many movements of cattle had been made through the Okeechobee Auction Market and through private sales to many points in other counties. It then became necessary for employees of the State Livestock Sanitary Board to examine market records, to investigate history of private sales, to trace such cattle movement to destination and to make repeated inspections of cattle at widely scattered points because of these exposures.

Fortunately, to date, only two small reinfestations have been discovered, one in Polk County near Polk City, the other in Palm Beach County near West Palm Beach. However, hundreds of premises involved by these movements are still under quarantine for observation. In addition, the Board is conducting tick inspection at auction markets throughout the State. Specimens of ticks have been received for classification from 50 counties and including 1,110 lots of cattle.

Many difficulties are encountered in the present campaign:

At the start no funds were available. Labor and materials are extremely scarce and costly. Although we have finally installed the necessary dipping equipment, it is difficult to secure and maintain an adequate force of inspectors, range riders and line guards. We even have labor strikes to contend with.

The present tick eradication program involves about 125,000 head of cattle. Most of this number are being dipped regularly every 14 days; the remainder are on a dipping-inspection schedule of 30 to 60 days.

In April, 1946, the authority of the Board in connection with this work was questioned, and five suits are now pending against the Board.

Notwithstanding the obstacles enumerated, tick eradication is progressing satisfactorily in Highlands and Okeechobee Counties. However, in Glades County, during September, of about 30,000 head dipped and inspected, 1600 tick-infested cattle were found.

From this account it will be readily understood that the Board has a big job on its hands. Each veterinarian in the State can help in molding public opinion, and in reporting to the State Veterinarian, rumors or observations of tick infestation. And, last but not least, because of his understanding and position, he can influence lawmakers and public officials to refrain from doing anything to hamper the prompt eradication of this cattle pest by the established methods of the past.

The imposition of difference of thought, court orders, or opposition in any form will only retard the completion of this work.

The application of the old slogan of the United States Bureau of Animal Industry, "Dip that tick," meaning the dipping of all cattle, horses and mules in a tick-infested area, has proved successful in the past. This was especially true when fever ticks were originally cleared of ticks from the entire infested South. With proper cooperation, the same old plan will be successful in the reinfested Okeechobee area.

* Presented at the 17th annual meeting of the Florida State Veterinary Medical Association, St. Petersburg, Oct. 28-29, 1946.

Studies in Immunity*

By H. C. SMITH
Sioux City, Iowa

THE correlation of disturbances of physiological function with changes of form and structure of body cells is the cornerstone of scientific medicine. In recent years the rapid advances in bacteriology, immunology, chemistry, antibiotics and the cultivation of viruses on chick embryos have advanced veterinary science. Every discovery in cellular structure, be it physiological or pathological, raises a question as to its practical significance.

Ehrich and Harris[1] first showed that the cellular response in the lymph nodes during antibody production is chiefly lymphocytic.

Harris *et al*[2] demonstrated that the lymph node antibodies are contained largely in the lymphocytes during antibody formation. The lymphocyte functions as a vehicle for the antibody.

Ehrich and Harris[1] pointed out that the reticuloendothelial theory of antibody formation is not supported by evidence in its entirety. Evidence is available that the lympocytes have something to do with the gamma globulins and antibodies in that they either store or produce globulins.

Immunity can no longer be limited to a knowledge of antibodies and phagocytes. Some of the newer drugs and antibiotic agents exert not only a pharmacologic action but an immunologic action as well.

The reactions of the body tissues to animal parasites may not differ from the reactions to bacteria and proteins.

Experiments have shown that the defensive mechanism against infection is not so much a reaction of the body as a whole as it is a reaction of a given tissue of the body—the tissue which is the primary seat of the infection or through which the organism invades the body.

Experiments have demonstrated and a vast amount of clinical observation has confirmed, that killed cultures of some bacteria are capable of inducing immunity in animals. Suspensions of these killed bacteria consisting of proteins, fats, sugars, complex organic substances and inorganic salts are used as vaccines, or more properly, bacterins.

There are two types of reactions that produce immunity:

1. Reactions to pathogenic organisms.

2. Reactions to harmless non-living antigens.

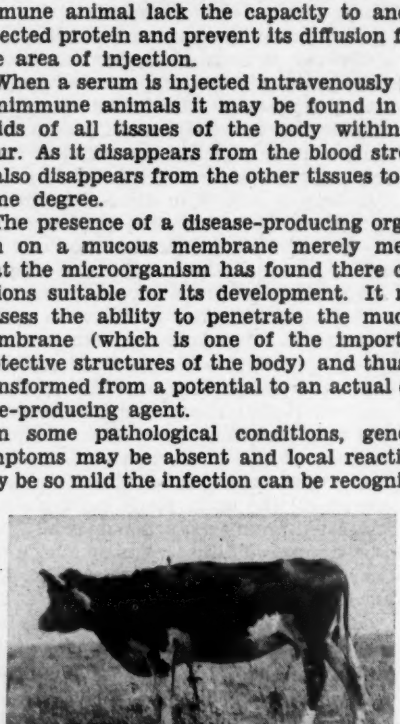
When a protein antigen is introduced into the tissues of an animal, either by injection or natural infection, a local inflammatory reaction results. This may be a defensive mechanism carried on by all cells of the body or a reaction in a single tissue.

When protein is injected into the tissues (intramuscularly) of a nonimmune animal, the protein (serum) gradually disappears from the area of injection and can be found in the blood stream soon after injection (½ hour). It is evident that the tissues of a nonimmune animal lack the capacity to anchor injected protein and prevent its diffusion from the area of injection.

When a serum is injected intravenously into nonimmune animals it may be found in the fluids of all tissues of the body within an hour. As it disappears from the blood stream it also disappears from the other tissues to the same degree.

The presence of a disease-producing organism on a mucous membrane merely means that the microorganism has found there conditions suitable for its development. It may possess the ability to penetrate the mucous membrane (which is one of the important protective structures of the body) and thus be transformed from a potential to an actual disease-producing agent.

In some pathological conditions, general symptoms may be absent and local reactions may be so mild the infection can be recognized only by bacteriological procedures. Three possible states may result from this:



The shedder eliminates pathogenic organisms in the excreta or secreta

1. Shedder—an animal that eliminates pathogenic organisms in the excreta or secreta.

2. Carrier—an animal that has one or more foci of infection in its tissues but evidences no symptoms of the disease and is not a shedder.

3. Convalescent—an animal in which the

* Presented at the 17th annual meeting of the Florida State Veterinary Medical Association, St. Petersburg, Oct. 28-29, 1946.

organisms persist longer than the recognizable clinical signs of the disease.

Septicemias

In many septicemic disease (streptococcic infection, brucellosis) it has been noted that usually the causative organisms are less likely to be isolated from the blood during an afebrile stage than during a febrile period. There is a difference of opinion as to just when bacteria multiply in the blood stream and there are exceptions to all rules so far formulated for this phenomenon.

A small number of infective agents, in part inhibited, may never multiply to a level which incites clinical symptoms. Under certain conditions the infection may remain latent, either through a long period of incubation or for variable periods between primary attacks and relapse. This is probably due to the fluctuations in the virulence of the causative agent or in the immunity of the host.

The virulence is probably controlled, to a large extent, by a change in the agent itself and by nutritive effects which control its multiplication. Environment changes constantly.

Disease agents, bacteria and viruses, are subject to influences of varying intensities during the incubation period in the animal's body—the onset, the peak of the infection and during the healing process, as the resistance of the host first falls, then builds up to a point, where the invader is overcome. If the development of immunity fails or is not in time, the host succumbs.

Leucocytic Counts in Infections

Munger (Michigan Tech. Bul. 177) found that a leucopenia with relative lymphocytosis is a feature of brucellosis in man, particularly if the infection is due to the melitensis type. The polymorphonuclear leucocytes are significantly reduced in number. This reduction is due to a destruction of the cells in the circulating blood by some toxic substance derived from the Brucella organism.

Reports from Mexico showed that in 115 cases of the melitensis type of brucellosis in persons, confirmed by isolation of the organism, 50% revealed a leucopenia. The other 50% of the cases, whether acute or chronic, had normal or increased white cell counts. It was concluded that the variation was due, in part, to a considerable variation in the clinical forms of the disease.

Huddletson and his associates (Michigan Tech. Bul. 156) isolated from Brucella a toxic factor capable of inducing a considerable reduction of polymorphonuclear leucocytes after subcutaneous injection into guinea pigs. Since the Brucella organisms are found in considerable numbers in most organs and tissues after death from acute brucellosis, there is no reason to exclude the bone marrow from damage that would result in a considerable modification of the leucocytic picture. This idea has not been established because some cases have been studied in which there occurred a definite reduction of white cells, yet there was no change in the bone marrow.

Treffers (Yale Union School of Medicine) who worked with *Shigella dysenteriae* and typhoid groups of organisms, has shown that a single injection of undetoxified Shigella antigen into rabbits will produce a rise in temperature of 2.5°F., with a characteristic initial drop in the white cell count, followed by an increase. When repeated injections were given, the temperature rose to as high as 3.6° F. above normal, with an increase in the white cell count after 38 hours.

In our experiments on pigs, averaging about 75 pounds in weight, standard swine enteritis bacterin was injected subcutaneously in doses of 2, 5, 10, and 20cc. These dosages produced a marked drop in white cell counts 24 hours later, which was maintained for three days. After the third day the white cell counts increased rapidly, indicating a marked resistance on the part of the animals. This rise in the white cell count was followed by another fall and a second rise which was sustained.

We concluded from these results that, following the administration of a bacterin, there is a drop in the white cell count (leucopenia) which in all probability coincides with a negative phase or a lowered resistance to the type of organism from which the bacterin was produced. Later this is followed by an increase in the white cell count (leucocytosis) indicating an increased resistance.

Blood Brain Barrier

When drugs or sera are injected into the blood stream, the effects differ from those resulting when these agents are injected into the fluid of the spinal canal. This is due to the defensive action of the blood brain barrier, which comprises the cells lining, the small capillaries and the neuroglia cells of the brain. This barrier protects the central nervous system from certain external influences. It also possesses a selective permeability not only for substances foreign to it, but also for various natural products of general metabolism. This defensive action increases with age and varies according to physiologic condition and changes during pregnancy. For example, in animals heavily drugged with alcohol, even a slight change in the environmental temperature affects the permeability of the barrier. This selective permeability safeguards health by protecting the nerve centers against invasion of toxic substances, but in therapy the barrier

may be a disadvantage by preventing therapeutic substances from penetrating from the blood stream to the diseased nerve centers.

A therapeutic agent may be brought into contact with the central nervous system in two ways: By lowering the resistance of the barrier (by increasing its permeability) and by avoiding the barrier altogether and introducing the agent directly into the space beneath the meninges.

Environment

There is sufficient experimental evidence that environmental temperatures play a significant role in modifying resistance to infectious diseases of bacterial origin. Some investigation has been made to determine its effects on the course of virus diseases. It is a well-known fact that metabolic rates tend to increase upon exposure to cold and decrease at higher temperatures. This alone may influence the rate of growth of a virus within the tissues of the body of the animal.

The practical significance of this may be observed in the shipment of livestock, either by train or truck, during changing climatic conditions. Exposure to cold would tend to create increased susceptibility by an increased metabolic rate in the animals and a condition possibly favoring rapid growth and spread of infection through the body tissues.

Seasonal changes are also possible factors. For example, the change from summer to fall, when the cool nights following warm days might interfere with virus growth to such an extent as to lengthen the incubation period. Even in the tropics where there is little change in temperature, seasonal changes affect the growth of plants. The sudden exposure of animals to extreme cold may not only increase their susceptibility to infectious agents, but may also increase the severity of the resulting infection. Certain factors may facilitate invasion of the mucous membrane by infectious agents. In addition to climatic and environmental conditions there are other factors—*e.g.*, age and food.

Capacity of Bacteria to Multiply in the Animal Body

The influence of the environment upon the resistance offered by the tissues to the multiplication of bacteria within the body of an animal was first demonstrated in the chicken.

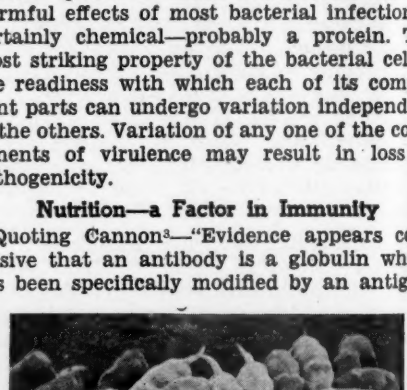
Fowl are refractory to anthrax organisms due in part to the high temperatures that are normal in birds. Lowering their temperatures renders them susceptible to the *B. Anthracis*. Also, immersion in cold water results in a number of modifications in the physiology and in the normal defense mechanisms of the chickens which may affect the infectious processes greatly. Strains of pathogenic organisms differ in optimum temperatures for survival and multiplication and these differences significantly affect their pathogenicity for a given animal.

A great variety of other factors such as nutrition, gases, acid and alkaline properties, etc., affect the ability of a microorganism to multiply in the animal body. The bacterial cell undergoes, during its growth, certain changes in physiological and biochemic properties. Therefore, it is not surprising that the number of bacteria which are required to establish a fatal infection varies greatly with the age and activity of the organism. Bacteria in the inactive phase of growth are readily disposed of by the defensive mechanism of the body, before multiplication can take place.

It has been shown that pathogenic bacteria produce a variety of substances which promote their invasion into the tissues of the animal. Such substances are aggressions, toxic products, enzymes, fibrins and coagulases. Like virulence, invasiveness summarizes an immense variety of factors which influence the capacity of a given bacterium to multiply in the body of a certain species of animal. The basis for the harmful effects of most bacterial infection is certainly chemical—probably a protein. The most striking property of the bacterial cell is the readiness with which each of its component parts can undergo variation independent of the others. Variation of any one of the components of virulence may result in loss of pathogenicity.

Nutrition—a Factor in Immunity

Quoting Cannon[3]—"Evidence appears conclusive that an antibody is a globulin which has been specifically modified by an antigen.



Acquisition of a high level of immunity requires an adequate intake of food

Clinical, chemical and experimental observations indicate that acquisition of a high level of immunity requires an adequate intake of food—particularly of protein. Factors essential for the process of protein synthesis may also be important, but the dietary provision of an adequate supply of protein of good biological quality is necessary to insure the avail-

ability of amino acids for globulin synthesis. Loss of acquired immunity manifests itself, especially in diseases characterized by a marked protein deficiency."

Elman and Davey[4] have shown that dogs maintained on a diet of horsemeat for three to five weeks before repeated fatal hemorrhage, withstood a larger amount of blood loss than those receiving a non-protein ration.

Cannon, *et al.*, report a relationship between malnutrition and reduced resistance to infections. Krebs has demonstrated a correlation between a low gamma globulin level in the blood and an inability to form antibodies or a failure to develop immunity.

Wissler, *et al.*, found that feeding adequate amounts of high quality protein leads quickly to a restoration of the antibody-producing mechanism in animals that have been maintained on an inadequate ration. They have shown further that antibody production depends upon an adequate supply of amino acids, which must come either from food or the animal's own protein stores. When both of these sources are depleted, the antibody-producing capacity is markedly reduced. This capacity can be re-established by feeding a ration containing adequate, well-balanced quantities of protein.

When a veterinarian is called to see an animal that has been vaccinated for the prevention of canine distemper, rabies, hog cholera, equine encephalomyelitis or bovine brucellosis and finds it affected with the disease from which it was supposed to have been protected, he is badly advised to jump to the conclusion that (1) the vaccine was not up to standard or (2) the fault lies with the vaccinator. There is another factor involved in the production of immunity—the animal vaccinated. The fault may lie with the animal. Its ration at and since the time of vaccination, and its health history for the same period should be inquired into before hasty conclusions are stated as facts or probabilities.

Immunization Against Bacterial Infections

Antibody production against a given substance or bacterial suspension is commonly referred to as immunization—irrespective of whether the eventual outcome is beneficial to the animal, as in the case of resistance to infection, or unfavorable as in the development of an allergic state.

In veterinary medicine at the present time there are three types of bacterial substances used to stimulate the formation of antibodies; *i.e.*, the production of immunity:

1. *Immunization with attenuated living cultures.*—Many methods have been advocated of attenuating cultures to be used in prophylactic immunization. Most of them have consisted of growing or maintaining the infectious agent in an unfavorable environment, such as allowing cultures to age, incubating at high temperatures, cultivating in mild antiseptics—thus changing a virulent culture into an avirulent one. Examples of these are the present-day anthrax spore vaccine and Strain 19 brucellosis vaccine.

2. *Immunization with suspensions of killed bacteria.*—Immunizing methods, or established efficacy, have been obtained against very few species of pathogenic bacteria with killed organisms; *i.e.*, bacterins. Organisms are inconstant in their structure and behavior to a degree that they exist in several forms, chemical composition and virulence. They vary also in their antigenic properties and great care should be taken in their selection for the preparation of bacterins. Virulence is not a gauge of antigenic properties. A strain may be highly virulent but low in antigenicity.

3. *Immunization with extracts or products of bacteria.*—Some bacteria produce both endotoxins and exotoxins, which may be soluble in the medium in which they grow. Some of these toxins stimulate antibody production as much as does an infection by the bacteria that produced the toxin. Immunity is directed against the toxins rather than against the bacterial cell itself. Examples of these are the "toxoids" such as tetanus toxid, diphtheria toxin-antitoxin and the staphylococci toxoid.

Factors Affecting the Stability of Bacterial Antigens

Bacterial antigens are organic substances. It is not surprising that they may be altered by heat, cold, chemicals and light.

One of the chief objections to the use of heat to sterilize suspensions of bacteria is that this procedure results in the denaturation (insolubility) of the proteins.

Phenol, trikresol and formaldehyde are the agents commonly used for the chemical sterilization of bacterins. Each of these produces certain chemical changes in the product which render the bacteria innocuous. Chemical sterilization like other forms must be accomplished with care, since the antigen may be completely destroyed as an immunizing agent by its use.

Application of Vaccines

The skin—the natural protective covering of the animal body—is probably the organ of choice in which to place any antigen or vaccine whenever possible. One of the first intradermal vaccines to be developed was spore vaccine for anthrax. This method of vaccination is now carried on in areas where anthrax is a great hazard.

Following the propagation of the virus of equine encephalomyelitis on the chick embryo, an intradermal vaccine was developed. This

vaccine, when injected into the layers of the skin in doses of only 1cc, produces a high degree of resistance to the virus.

In our research in Oklahoma, we used 0.2cc of the regular brucellosis vaccine (Strain 19) injecting intradermally in the caudal fold of both calves and adult cattle. It produced sufficient immunity to resist ordinary barn and pasture infection. Animals injected by this method developed a high agglutinating titer which, however, disappeared promptly, leaving the animals negative on subsequent tests.

McIvor and Cherney[8] have shown that it is entirely possible to immunize a dog against fleas. Encouraging results were obtained in the actual treatment of cases sensitive to flea bites. Curiously, no circulating antibodies or precipitins were demonstrated in the blood of individuals treated with the flea antigen.

Variation in Viruses

Outstanding characteristics of some viruses are their capacity to undergo modification. Even in the different strains isolated from a single epidemic, there may be antigenic differences. This is particularly true when we transfer a virus from one species of animal to another.

From the standpoint of immunity it is interesting to note that a young animal produces a specific type of antibody while an older one exposed to the same stimuli produces one of much broader activity. This is probably explained on the basis of past multiple infections, since virus immunity is the result of invasion of the cells by the virus; resulting in local necrosis of the cell and secondary inflammation. The faster the spread of infection over the surface, the less circulating antibodies will be formed. On the other hand, the lower the virulence of the virus, the more antibodies will likely be produced. The practical application of this is shown in upper respiratory infection (influenza) where the virus spreads from cell to cell by contact, requiring no passage through the blood or tissue fluids.

Viruses

Many problems pertaining to viruses may eventually be solved by accumulated knowledge developed by research during the past few years. Different investigators have penetrated a little farther each year into the unexplored regions of this field. Due to a vital interest in specific virus diseases, the veterinarian needs no inducement to arouse his curiosity about viruses in general.

Viruses have many properties suggesting that they are living organisms. For example, they multiply as do other living organisms; they may be destroyed by chemical agents; they adapt themselves to different species of animals, thus producing different pathological conditions and diseases.

One characteristic peculiar to them is the inability to multiply except in living tissue. Chemically they are composed of carbon, nitrogen, hydrogen and phosphorus, which supports the theory that they may be nucleoproteins. Some have even been crystallized, which supports the theory that they are lifeless molecules. Some investigators, however, question whether the crystals are pure virus or whether the virus is a contaminant of the protein of which the crystals are composed.

An incubation period, the time interval between the entrance of a virus into the host and the appearance of symptoms, is a characteristic feature of a virus disease. The interval may vary greatly in duration. Having gained access to the tissues of the host, a virus may cause either a generalized infection throughout the body or exert a selective affinity for one type of tissue. The mode and rate of virus excretion is of interest to every veterinarian because it is already apparent that in some instances viruses may remain for a considerable period in the tissue of an animal; *i.e.*, produce carriers.

Viruses seem to have the ability to change their form with the added facility of causing one kind of damage to the body on one occasion and quite a different type of injury on another occasion. The clinical symptoms produced by a virus depend on the body cells which it invades. An example of this is the virus of canine distemper—which has an affinity for epithelial tissue and nerve tissue. Thus it may produce an acute encephalitis in the dog, characterized by all of the neurological symptoms; or, invading the epithelium of the respiratory tract, it may produce rhinitis, bronchitis and pneumonia. In another case the symptoms may be predominantly viscerotropic —due to invasion of the epithelium of the intestinal mucosa, and the result is enteritis and diarrhea. In still other cases, the symptoms may be confined to the skin—the so-called dermatropic distemper — comprising vesicles, papules and pustules on the abdomen.

Bacteria cause disease, and may cause death, by destroying tissue and excreting toxins which the body cannot tolerate. Bacteria are living organisms which require food for growth. This they obtain from the fluids of the animal body —from the blood stream, from the intercellular fluid of tissues and from the intracellular fluid of the tissue cells. Antitoxins, antisera, chemotherapeutic agents and antibiotic agents injected into the blood stream can attack these organisms and destroy them, or inhibit their growth until such time as the natural defensive forces of the body can overcome them. The

veterinarian, by virtue of his education and training, is the logical one to select the proper agent, administer it in the proper amount and at the proper intervals to accomplish the desired results.

Viruses cause disease in a different manner. They invade the body cells, are highly specific as to the type of cell in which they grow. The virus of rabies attacks nerve tissue; the influenza virus attacks respiratory tissue; the pox virus attacks the skin; foot-and-mouth disease virus attacks the feet, the mucous membrane of the mouth and the udder, etc. Viruses are difficult to reach with combatant agents because they enter directly into the body cells, while all our chemotherapeutic, antibiotic and biological agents remain in the body fluids. Antibiotics, antisera, chemicals and biological agents can reach viruses only during the brief interval when the virus, having destroyed a cell, abandons it and migrates to another to attack it.

Research has shown that the cells of immune animals contain some substances, or possess some change in the cell structure which prevents the virus from entering. When the nature of this substance or cellular change is definitely determined, the mechanism by which viruses cause disease will be better understood. One interesting observation made in recent years is difficult to explain, to wit: when a virus has invaded a cell, that cell is not attacked by other viruses. This suggests the possibility of inoculating the animal with a harmless or attenuated strain to prevent invasion by the more deadly strains of the same virus. The use of cowpox virus for vaccination against smallpox and pigeon pox vaccine to prevent fowl pox are examples of this protection against a deadly virus which inoculation with a mild virus sometimes affords. A danger in this procedure lies in the facility with which viruses change their character. A virus which normally causes only a subclinical infection may change rapidly to a virulent one when highly susceptible cells are available for its rapid invasion.

Active Immunization Against Virus Diseases

When an animal recovers from a virus disease, it generally possesses a high degree of immunity against the virus responsible for the infection. Second attacks are rare, although they do occur. Examples are recurrent attacks of swine influenza, equine encephalomyelitis and of course the "common cold."

Progress has been made in bringing about immunity against virus diseases by artificial means. It has been known for some time that a successful vaccine may be produced for one virus and not for another. The opinion has been held that immunity could be produced by only a virus that would actually produce infection in the animal. The administration of a living virus to an animal for immunization is attended by danger unless it be modified or attenuated in some way.

It is claimed by some that the use of hog cholera virus and hog cholera antiserum, administered simultaneously cannot eradicate hog cholera from the swine of this country. This shows a misconception of the nature of the disease. Disease is stopped, eradication achieved, by preventing the causative parasite from reaching a susceptible host. This may be effected just as certainly by rendering the host nonsusceptible as by killing the parasite or killing the host or keeping them apart by quarantine. For those diseases for which we have an effective vaccine, vaccination frequently is much the easiest and most economical means of eradication. It has the drawback of making control of the disease so practicable that there may be little public support for eradication which, of course, as with any eradication procedure, must be all-embracing. A second drawback to a vaccine is the fact that it may fall into unauthorized and incompetent hands and be used promiscuously, but so may an automobile for that matter.

Virus—Vaccine—Immunity

Immunity induced by attenuated virus (vaccines) is usually less prolonged than that stimulated by the live virus, due probably to the fact that the unmodified virus is better able to live and multiply in the tissues and to give rise to a more marked and prolonged antigenic stimulus.

The use of vaccines involves little risk of reproducing the disease, but it is necessary to establish the fact that in attenuating the virus by either chemical agents, heat or light rays, the immunogenic activity is not also destroyed. Properly modified viruses appear to be effective immunizing agents in those diseases which leave the victim immune after an attack. Immunity following the use of virus vaccines usually is relatively slow in developing; it may be of such short duration as to require revaccination at varying periods.

Immunization Against Virus Diseases

The serum of animals that recover from a virus disease, known as convalescent serum, contains antibodies against the causative virus in a high degree. Therefore, when used in large doses, this serum may be useful as a therapeutic agent against the same virus attacking another animal.

A hyperimmune serum may have a potency hundreds of times that of convalescent serum for the same disease. Examples of hyperim-

mune serums are hog cholera, canine distemper, feline panleucopenia and equine encephalomyelitis antisera.

Because of its greater potency, a smaller amount of hyperimmune serum than convalescent serum may be required to bring about satisfactory results.

After the virus has been well established in the tissues in acute virus infections, serum as a therapeutic agent is usually disappointing. Opinion seems unanimous that once the infection has been firmly established within the body cells, serum therapy is of little or no value. When given in the very early stages

This pig was given two million lethal doses of hog cholera virus. Because it was also given a small dose of hyperimmune serum; it did not develop hog cholera, but did develop strong, long lasting immunity to the disease

of any virus disease, some success is claimed.

The probable explanation for the failure of serum therapy, particularly when administration is delayed, is that the virus multiplies within susceptible tissue cells and by virtue of its intracellular position the virus cannot be reached. When given early, the penetration of healthy cells by the virus may be prevented by the antibodies of the serum.

This explains the fact that if an antiserum is given immediately after exposure to a virus, infection is usually prevented. If an antiserum is given several days after the exposure, the attack may be modified—reduced in severity—as far as symptoms are concerned; but if administered in the late stages of incubation, or at the onset of a clinical attack, the antiserum is without appreciable effect in most cases.

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Stable Organic Compounds Easily Reduced

The discovery in 1945 of a new reducing agent, lithium aluminum hydride, by scientists of the University of Chicago engaged in a project at the U. S. Naval Research Laboratories, has just been announced.

This reducing agent is easily prepared from lithium hydride and aluminum chloride. Dissolved in ether it successfully reduces many organic compounds such as ketones, aldehydes, acid chlorides, etc., to their corresponding alcohols. With inorganic substances it has been used to prepare other metallic hydrides, some of which have never before been obtained in large quantities.

* * * *

Malignant Neoplasm in a Cow Cured by Stilbestrol

A tumor was removed from the wall of the vagina in a yearling Shorthorn heifer, with apparent success. Later the heifer was bred and at calving it was found the tumor had recurred and appeared to be malignant, being diffuse and covering the whole of the vaginal wall. Part of it protruded through the vulva. It was considered inoperable and the owner was advised to dispose of the cow at the end of the lactation.

In the hope of maintaining lactation for a longer period, and with no thought of anticarcinogenic action a one-grain tablet of stilbestrol was implanted in the subcutaneous muscle of the neck.

This implantation caused no alteration in the estrus cycle, which continued to occur at normal intervals. Five months after implantation nothing could be felt of the tablet so presumably it must have been practically absorbed.

Three months after implantation the part of the tumor protruding from the vulva had disappeared and the part inside the vagina was definitely regressing. After five months a lump of the size of an orange, on a well-defined pedicle, was all that remained. This was removed with an ecraseur, under epidural anesthesia. It was sent to the Royal (Dick) Veterinary College in Edinburgh for pathological examination. The report was: "Microscopical examination showed the tumor to be a typical cellular fibroscarcoma. Definitely it had the appearance of being capable of rapid growth."

The cow was served by the bull two weeks after removal of the tumor and is now safely in calf. Incidentally, 15 months after calving she is giving five quarts of milk per day.—R. D. Franklin, M.R.C.V.S., in *Vet. Rec.*, 58:15, 1946.

Some Common Nervous Ailments in Dogs*

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DOGS develop a large number and variety of diseases. Some of them seem peculiar to dogs, but most of their ailments are also common to other species of animals and man. In this paper some of the common nervous ailments only will be considered.

The diagnosis and clinical distinction of some nervous diseases are difficult because the symptoms manifested are not specific for any one causative agent. The character of the symptom manifested indicates only its site of origin and not its etiology. Various agents when they affect the same anatomic unit of the nervous system may produce similar symptoms. Certain general diseases and various organic and inorganic substances, too, can cause symptoms not unlike those of a primary nervous disease. Therefore, when dealing with nervous disease it is always important to consider carefully all factors which may have a direct or indirect bearing on the case and not be too hasty in arriving at the diagnosis.

Symptoms Produced by Disease in Various Sites

The cerebrum, cerebellum, medulla and the spinal cord are functionally interrelated but disease restricted to any one of these anatomic units may give rise to certain definite symptoms. Disease restricted to the cerebrum commonly causes fits, convulsions, various mental and psychic disturbances and in-co-ordination of thought and movement. It also may cause loss or impairment of sight and hearing but this may be due only to the animal's inability to comprehend what it sees or hears. Lesions present in the motor area usually cause severe generalized convulsions. Clonic rhythmic convulsions of one or more groups of muscles, commonly termed "chorea," are the most frequent focal symptom observed in dogs which survive an attack of encephalitis. They are common residual symptoms of the nervous form of canine distemper.

Disease restricted to the cerebellum commonly causes only ataxia with no disturbances of psychic or mental functions. However, if a lesion in the cerebellum is situated so that it obstructs the flow of the cerebrospinal fluid it also can produce symptoms of cerebral disease. Focal lesions present in the cerebellum may cause an animal to tilt its head or walk in a circle in the direction of the affected side, but, ataxia alone has been the most frequent symptom of cerebellar disease observed by me. An affected dog tends to reel and stagger when it attempts to walk and may fall over when attempting to void or defecate.

Lesions in the medulla can cause various motor disturbances, vomiting, Cheyne-Stokes respiration and irregular pulse. Paralysis of the muscles of mastication and deglutition are common symptoms observed when the nuclei of the cranial nerves furnishing motor innervation to these muscles are destroyed or their function is impaired. When this occurs, the dog's mouth remains open, the tongue protrudes and saliva drools from the mouth. These symptoms are common in rabies. Undoubtedly, the most constant occurrence of these symptoms in rabies is due to the route by which the specific virus of rabies travels to the brain and the fact that it has an affinity for the nuclei of nerves. If the virus gains entrance through a bite or wound on the body or a limb, it travels along one of the nerve trunks to the spinal cord and thence through the medulla to other parts of the brain. Under these circumstances paralysis of the muscles of mastication and deglutition occurs before symptoms of cerebral disease are manifested. But if the virus of rabies should gain entrance to any one of the fifth to twelfth pairs of cranial nerves through a wound on the head, it can go directly to the higher centers of the brain without passing through the medulla and the typical symptoms of rabies mentioned would not develop. The symptoms then would be like those seen in animals affected with other kinds of encephalitis.

The spinal cord is the direct continuation of the medulla. It is the pathway through which is conveyed impulses from the brain to all parts not innervated by the cranial nerves and it also conveys impulses from the periphery to the brain. It also contains some special nerve centers which have to do with various involuntary functions. The ciliospinal center, which is situated at the junction of the cervical and thoracic portions of the spinal cord, gives

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innervation to the dilator muscles of the iris and the vesicospinal and anospinal centers in the lumbar portion of the spinal cord control the sphincters of the bladder and anus. Destruction of the ciliospinal center causes contraction of the pupil and stimulation of this center causes dilation of the pupil. Destruction of the vesicospinal and anospinal centers cause urinary and fecal incontinence.

Diseases of the spinal cord produce various sensory and motor disturbances but not fits or convulsions. Weakness and paralysis are the most frequent symptoms observed. The paralysis may be spastic or flaccid. Diseases which affect only the large motor nerve cells in the anterior horns may cause fibrillary twitching, spasms, weakness, flaccid paralysis and abolition of the reflexes at the level of the lesion. Lesions affecting the motor tracts depending on their character may produce either spastic or flaccid paralysis but not abolition of the reflexes. The reflexes may be exaggerated. A lesion which causes pressure on a motor tract commonly produces a spastic condition of the muscles below its level on the affected side, but if the pressure is severe and the cord is destroyed, flaccid paralysis develops. These symptoms are observed frequently in dogs affected with prolapse or hypertrophy of one or more intervertebral disks. During the early phase of this condition the affected animal commonly extends its hind legs forward when sitting or lying. The animal also usually will hold the back rigid when it is lifted or handled, and in some instances resents being lifted or handled.

Etiologic Factors and Symptoms They Produce

The etiology of nervous diseases is various, but as stated before, the symptoms may be similar. Neurotropic viruses are a frequent cause of destructive encephalitis and myelitis. The virus of rabies was once a common cause of fatal encephalitis among dogs, but because of its public health importance this disease is now being controlled and has been eradicated in some states. When nervous disease among animals is encountered, however, rabies should be considered because it still exists in many areas and the present means of transportation make it possible to move an exposed dog long distances.

Although other neurotropic viruses undoubtedly produce nervous diseases among dogs, in my experience the virus of canine distemper is the most frequent single cause of these conditions. It commonly shows a predilection for the tissues of the respiratory system and produces an influenza-like disease. In its natural state it often appears to undergo changes in both virulence and affinity for certain tissues or anatomic systems. It, at times, appears to become so highly virulent that all recognized methods of treatment seem ineffective and, at other times, seems to lose its virulence to such an extent that almost any treatment is attended with good results. This virus, also, not infrequently develops an affinity for the nervous system and produces a severe form of disease which is characterized by various nervous symptoms. The disease produced may begin as the usual form of distemper and the nervous symptoms may develop later or, as not infrequently happens, the nervous symptoms may be observed first and the others later, if at all.

The sudden occurrence of fits often is the first symptom noted when the nervous form of distemper is developing. These convulsions may

If the virus of rabies is inoculated into any one of the 5th to 12th cranial nerves, it invades the higher centers of the brain without passing through the medulla and the typical symptoms of rabies do not develop. In such cases the symptoms are those seen in all kinds of encephalitis

occur only once, but usually they recur successively until other symptoms develop and in some instances until the animal dies. Uneasiness and discomfort also are common early symptoms of this form of distemper. The affected animal may change its position more frequently than normal or it will move about from one place to another in a restless manner, and may whine or cry for no apparent reason. The whining usually is more noticeable when the animal is sleeping. These symptoms are observed more frequently when the spinal cord is affected. As the disease progresses, other more common symptoms of distemper or further nervous disturbances may develop. The nervous symptoms most frequently observed are recurrent epileptiform seizures and rhythmic clonic convulsions of one or more groups of muscles. But various other nervous disturbances, such as mental impairment, in-co-ordination of movements and paralysis are not uncommon. Paralysis occurs only when the spinal cord is affected.

Dogs also develop a wide variety of nervous disturbances which are not caused by the virus of canine distemper. Some of these conditions are of frequent occurrence. In 1941 I[1] infected young dogs experimentally with the virus of western equine encephalomyelitis, but I doubt if this is a frequent cause of encephalitis among dogs. Beckman and Torrey[2] in 1941 isolated a neurotropic virus from dogs which they concluded was different from that of canine distemper but their work has not been confirmed by other investigators.

Various lesions characterized by degeneration of the nervous tissue are encountered frequently in dogs, but the causes of these lesions are not known. In many instances they may be the residual effects of the virus of canine distemper or other viruses, but this has not been proved. And, too, I sometimes wonder whether the lesions observed are responsible for the symptoms noted because, Essex, Keith and I[3] produced large lesions in the cerebrum of dogs and noted only transient symptoms.

Intestinal parasites have long been regarded as a common cause of convulsions among dogs. Worms of the genus Ascaris undoubtedly sometimes cause fits in young puppies and hookworms and whipworms occasionally cause fits in adult dogs. Intestinal parasites, however, usually do not cause nervous symptoms only.

Eating is common to all animals and man and, since the dog has followed man to all parts of the world and has often been forced to subsist on diets which seem unnatural for the animal, it has been easy to blame the diet for many of the dog's ailments. But, when certain diets are fed to dogs in order to produce certain conditions said to be due to the diets, it is soon learned that a dog can subsist without apparent ill effects for varying periods on a wide variety of foods. Potatoes and bread have often been credited with causing various abnormal nervous conditions in dogs. Yet Berryman and I[4] gave only potatoes and skim milk or bread and skim milk to young dogs for a period of one year without producing any abnormal conditions in them. A deficiency of thiamine in the diet too has been credited with causing hysteria in dogs. I have fed dogs various diets which were known to be deficient in thiamine but never was able to produce hysteria by this means alone. Impairment of the appetite is usually the first symptom noted when a thiamine deficient diet is used. When

When a neurotropic virus attacks the cord paralysis ensues. It does not differ from paralysis due to other causes

an animal stops eating, it also becomes deficient in other things and thiamine alone cannot be blamed for all of the symptoms which develop later.

Certain diets or food stuffs, however, do cause nervous symptoms among dogs. The most important of these is wheat gluten. Wagner and Elvehjem[5] in 1944 reported data which showed that the addition of as little as 10% of wheat gluten flour to an otherwise normal diet would consistently produce fits in young dogs. The occurrence of these convulsions was not prevented by the addition of casein, thiamine, dried canned dog food or lysine hydrochloride. When the food contained 10% of wheat gluten, fits developed in 22 days and when the amount of wheat gluten in the diet was as great as 25%, they occurred as early as seven days after use of the diet was begun. Morgan and Groody[6] (1944) reported the occurrence of running fits in dogs that were fed a commercially prepared

dried dog food containing 20% protein. Fits developed in five days on the diet which consisted entirely of this food. These authors later reported[7] that the convulsions did not occur when fresh ground beef lungs, meat scraps and fish were added to the diet. They were of the opinion that one or more of the amino acids were involved in the production of fits in these dogs. It is doubtful, however, if the diet is a common cause of fits among dogs because they commonly are given a wide variety of food

Differential Diagnosis

The nervous diseases of dogs usually cannot be distinguished clinically. In most instances the site of origin of the symptoms only can be determined. The character of the lesions present in the nervous system can be determined definitely only at necropsy and by microscopic examination of the affected tissues. The presence of rabies and canine distemper can be determined accurately by animal inoculation experiments and by the presence of certain specific inclusion bodies in certain cells. The significance of Negri bodies has been recognized since 1903. According to Green and Evans,[8] Lentz in 1907 first called attention to the cell inclusion bodies which now are considered specific evidence of canine distemper. He described them as round or oval acidophilic, homogeneous bodies, situated either free in the tissue spaces or in cytoplasmic remnants of cells. We now know that these bodies are present in large number in the cytoplasm of the epithelial cells in the respiratory system, liver and the urinary tract. In the living animal satisfactory results can be obtained by examination of epithelial cells obtained from the respiratory tract by means of a swab. In the dead animal I prefer to examine tissues from the urinary bladder for inclusion bodies. The epithelial cells in this organ develop an abundance of distemper inclusion bodies in animals affected with this disease. I use this method in the differential diagnosis of canine distemper from other diseases.

It is also thought that dogs, sometimes young dogs in particular, develop fox encephalitis. This too, can be distinguished from the other kinds of encephalitis by demonstration of the presence of specific inclusion bodies. The inclusion bodies of fox encephalitis occur in the nucleus of endothelial cells of the blood vessels in the brain. Moderate unilateral or bilateral hydrocephalus has been observed frequently in dogs which have recurrent attacks of fits. But also, in many instances, I have failed to find any lesion in the brain of animals which manifested nervous symptoms over a period of months or years.

Treatment

The treatment of nervous diseases is generally unsatisfactory. Best results can be obtained in those conditions caused by agents which can be eliminated, such as certain diets or parasites and various organic or inorganic substances. These agents, however, usually produce only functional disorders. The prevention of distemper by prophylactic treatment with specific vaccines will control or prevent the occurrence of many cases of encephalitis. This has been observed over a period of many years in the kennels at the Institute of Experimental Medicine of the Mayo Foundation. The encephalitis which occurs in dogs outside of these kennels does not seem to be transmissible by contact to the dogs in these kennels that have been immunized to distemper.

Various sedatives and other agents have been employed to lessen the severity of fits in dogs, but none have been entirely or even moderately satisfactory. The occurrence of fits sometimes ceases spontaneously or they become less frequent as the animal grows older.

Among animals which have prolapsed or enlarged intervertebral disks, paralysis tends to disappear after a period of rest. In man, this condition is treated by both rest and surgical methods, but no satisfactory surgical treatment has been developed for use in the dog.

The poor results generally obtained in the treatment of nervous diseases are largely due to the fact that a nerve cell is unlike any other cell in the body in that once it is destroyed it is not replaced by another similar cell and the function it performed is lost.

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Veterinary Education in the Southeast*

By A. L. Shealy
Gainesville, Florida

THE demand of the returning G.I.'s for training in veterinary medicine is great. Many of them desired to pursue studies in this field prior to the war but were unable to do so on account of lack of financial resources and for other reasons. But they find it possible now to go to college and, naturally, they want to earn a degree in veterinary medicine. Every Land-Grant College in the southeast is feeling great pressure for courses in basic sciences that will fulfill the entrance requirements for matriculation in colleges of veterinary medicine. In a few states much propaganda has been disseminated for the establishment of institutions to give the degree of Doctor of Veterinary Medicine. The only college in the southeastern states giving a degree in veterinary medicine at this time, is the Alabama Polytechnic Institute. It has been swamped with applications from every state in the southeast, but especially from Florida.

As a result of these great demands for veterinary education, Dr. L. N. Duncan, President of Alabama Polytechnic Institute called a conference in Auburn in September, 1946, and at that conference a resolution was adopted that sets forth the policy that is being pursued at this time by the Land-Grant Colleges in this section. The resolution follows:

"It is the sense of the meeting that a most serious handicap to the development of the livestock industry in the South is the lack of adequate veterinary service, particularly in the fields of teaching, research, nutrition, poultry diseases, artificial insemination, parasitic diseases, general rural practice, livestock sanitary control, regulatory work and public health, including dairy and dairy farm inspection, meat and food inspection, and diseases of animals transmitted to man, brucellosis, tuberculosis, rabies, etc.

It is the further sense of the meeting that the minimum requirements are not adequate to provide the services to which the South is entitled.

To meet the above demands, it is the sense of this meeting that it will require anually 150 graduates in veterinary medicine, of which at least 100 should be trained in the South.

To supply 100 graduates annually, it is the opinion of this group that two well-staffed veterinary colleges, adequately financed in the matter of physical plant and maintenance, are needed.

On the basis of present conditions it is believed that it will take no less than $1,500,000 to $2,000,000, depending upon local conditions, to provide the desired physical plant.

To support the desired physical plant and teaching staff, an annual operating budget of from $250,000 to $275,000 must be provided.

For effective teaching, the student-instructor ratio should not exceed 20 students to one instructor and, in clinic, a ratio of six students to one instructor is necessary.

In addition to veterinary instruction it is necessary for the institution to conduct research work as an integral part of a well-rounded program in veterinary medicine. This research program should be administered as a definite department under the immediate supervision of the dean of the veterinary college. These facilities should be available for all staff members of the veterinary college, who should be given time and encouragement to pursue these activities. The research program of the veterinary institution will require $200,000 for land, building and equipment, and an annual budget of $50,000 for maintenance.

Modern veterinary education, like all medical education, is most expensive and cannot be made available in all states. Furthermore, it is neither necessary nor practical for all states to attempt to give this type of instruction. It would appear, therefore, in order to provide opportunity for men residing in states not having veterinary colleges and also to aid those states maintaining veterinary colleges, that contracts be negotiated between states having veterinary institutions and those not having such institutions. Such an arrangement, at a cost of approximately $1,000 annually per student, will cover cost of giving such instruction. Funds from such contracts should be paid directly to the state treasurer and the support of the veterinary college should come from ear-marked state appropriation."

By committee on veterinary education in the southeast,

I. D. Wilson — A. L. Shealy, Chairman
W. T. Oglesby — R. S. Sugg, Member ex-Officio

This report was unanimously adopted.

Since the Board of Regents of the University of Georgia has established a college of veterinary medicine in the University, the two colleges mentioned in the resolution have been provided and we feel they will be adequate for many years.

* Presented at the 17th annual meeting of the Florida State Veterinary Medical Association, St. Petersburg, Oct. 28-29, 1946. In the absence of Doctor Shealy, this paper was read by Dr. D. A. Sanders.

Clinical Reports

Anaerobic Spores in Sulfanilamide Powder

A Hereford calf, one month of age, was brought in for an operation with a history that it had not been able to straighten its legs since birth.

A diagnosis of congenital bilateral contraction of the flexor tendons of the forelimbs was made.

Correction of the condition was made by cutting the deep digital flexor tendons on both limbs following shaving and cleansing the area with detergents and antiseptics, and infiltrating it with a local anesthetic. The instruments and suture material used were all chemically sterilized before use.

Both limbs were prepared, operated on, and dressed in a similar manner with the exception that the incision on one limb was covered with a sulfanilamide pack while the incision on the other limb was simply given a protecting cover of sterile cotton.

Thirty-six hours after the operation, the calf was found dead in the stall. On autopsy, a diagnosis of malignant edema was made as the cause of death. The focus of infection was found to be in the incision covered with the sulfanilamide dressing.

In an attempt to determine the source of the infection, a small amount of sulfanilamide powder from the same container as used in dressing the surgical incision, was shaken into a sterile anaerobic meat broth culture. Forty-eight hours after inoculation the broth was examined microscopically and large, gram positive, spore forming rods were identified.

It was concluded that the sulfanilamide powder was a possible source, if not *the* source, of the anaerobic *(Clostridium septicum)* infection which killed the calf. In view of these findings, it appears that sulfanilamide powder, if not properly sterilized or stored after sterilization, may be contaminated with pathogenic bacterial spores that will develop in favorable media in spite of the presence of sulfanilamide. This case constitutes just another of many reminders that we should not relax our surgical aseptic technic and depend upon sulfanilamide to do that which we should do for ourselves.

SOL NOROTSKY

Columbia, Conn.

A Light Attack of Tetanus in a Horse

December 21, 1946, a farmer confronted us with the following history and symptoms of his large gelding Belgian horse. The horse was walking "spraddle-legged"; it moved rather slowly and with some difficulty. Dr. V. C. Hurtig, a practitioner at Courtland, Kansas, whom I was assisting, asked the farmer how long the horse had been in that condition. The farmer replied that the horse first acted peculiar about four days earlier. He said the animal ate and drank but that he hadn't observed it to urinate during the four days.

Suspecting the horse had a urinary calculus or some other urinary difficulty, we prepared accordingly and drove out to the farm.

As we came to the corral, we noted the horse was grazing and that he moved with some difficulty; stiffness being apparent in the hind quarters. The tail was arched and the ears were erect. Upon closer examination we found that the horse was chewing the grass quite slowly, his nostrils were dilated and the third eyelid was prolapsed over about one-half the surface of the eyeball. Palpation of the muscles revealed them to be firm and hard, especially those in the hind quarters. Temperature, pulse and respiration were normal. The horse exhibited no excitement or concern at our presence, and kept right on eating.

We made a diagnosis of tetanus. Further questioning of the farmer elicited the information that, two weeks previously, the horse had stepped upon an old harness buckle which had penetrated the soft tissues of the sole.

The wound was easily located and it was found to be quite infected. It was cleansed by flushing with an antiseptic solution, and then was packed with cotton dipped in the antiseptic solution. Ten thousand units of tetanus antitoxin were injected intramuscularly and one-fourth grain lobeline sulfate was injected subcutaneously. As the horse was moving about quite well and was eating, Doctor Hurtig told the farmer to allow it the run of the pasture, but if the tetany should become more severe, he should confine the animal in a dark stall.

A second call was made the following day and the treatment of the preceding day was repeated. The horse showed a slight improvement. A third call was made on the fourth day and the treatment again repeated. At this time the animal showed marked improvement. No additional calls were made, but a week later, in passing the farm, we stopped and found recovery to be nearly complete.

OTTO F. LUKE

Solomon, Kan.

These pairs of X-ray photographs show the femur in each leg before and after the splints were applied

Bilateral Fractures in a Dog

December 20, 1946, an 18-month-old, brown, bone, female coon hound was brought to clinic with both hind legs broken. Temrary splints were applied to reduce the danr of further trauma. Upon X-ray examinan bilateral femoral fractures were shown at epiphyses; the fracture being compound the right leg.

Penicillin and sulfathiazole ointments were plied to the wound. The following day mbutal was given until complete muscular axation was obtained. The factures were reed and a modified Thomas splint was apd (see illustrations). A fluoroscopic examiion showed the fractures to be satisfacily reduced. Fifteen thousand units of icillin was injected around the compound cture; penicillin ointment and sulfathiazole wder were introduced into the wound. On 22nd, and daily through the 26th of Deber, 10,000 units of penicillin was injected o the wound and penicillin ointment was d as a wound dressing. December 28th, cture of metaphen was applied to the und. Two days later, the 30th, the splints re removed and another fluoroscopic examiion was made. The fractured bones were nd to be completely aligned and united. me ulcers, caused by the splints, were ated with powdered boric acid for the next days. Tincture of metaphen was applied the wound area until the 9th of January. this date the dog was discharged from the ic. It was able to walk quite well.

The splints were made of No. 9 clothes-line e and were wrapped with adhesive tape. Gauze-covered cotton padding was placed at points where pressure would occur.

ARTHUR L. KELLY

San Diego, Calif.

Urinary Calculi in a Cocker Pup of Tender Age

The chief point of interest in this report is the occurrence of urinary calculi in a puppy so young. The literature contains only one report of calculus in younger puppies *(Vet. Med.*, November, 1945, p. 384).

During the summer of 1946 a male cocker pup, eight weeks of age, was presented for treatment with a history of inability to urinate.

The puppy showed distress and made frequent attempts to urinate. Palpation of the bladder revealed distension and evidence of constipation was present.

Butyn sulfate, 2% solution, was applied to the urethral mucosa, 1/100 grain of atrophine sulfate was injected subcutaneously to relax the urethral smooth muscle; ether anesthesia was induced and an unsuccessful attempt was made to introduce a catheter into the bladder.

No diagnosis was made.

Twelve hours after admittance to the hospital, rupture of the bladder resulted in the death of the patient. Post-mortem examination revealed the presence of an impacted mass of small stones with a fibrin clot, located in the prostatic portion of the urethra. Cystitis was present also and a urethritis of the prostatic portion of the urethra.

The etiology of this type of cystic calculi is

unknown. A number of theories have been advanced to account for this condition; among them being a deficiency of water, a high mineral content of the drinking water, a vitamin A deficiency and a calcium-phosphorus imbalance. However, adequate supporting evidence is lacking for each of these theories. There is need of more inquiry. The history of this case revealed no abnormalities either as to diet or environment.

C. E. HARDIN

Petaluma, Calif.

Orchitis in a Bull

A valuable, three-year-old, purebred Hereford bull, in show condition, weighing 1800 pounds was presented for treatment in December with the following history:

For months the bull had shown no sex drive. Then in September, the right side of his scrotum was noticed to be enlarging, he went off feed and had an elevation of temperature of two to three degrees. During this time the scrotum enlarged to about four times normal size, was hot and sensitive, and the animal lost some two hundred pounds in weight. With the use of sulfa medication *per os* and repeated applications of antiphlogistic packs on the scrotum, the temperature returned to normal. Most of the enlargement in the ventral part, but only a slight enlargement at the dorsal part of the scrotum remained. The heat and pain also disappeared.

Examination of the bull showed the left testicle, cord and left side of the scrotum was very near normal; the cord and the right side of scrotum being still enlarged as described by the owner. The right testicle was about one-half normal size, the epididymis felt normal and we could palpate something that felt a lot like intestine. Since the bull was too large and fat to palpate the ring thoroughly per rectum to determine if there was a loop of intestine in the scrotum we made a tentative diagnosis of orchitis and possible scrotal hernia.

The bull had no breeding value in this condition so it seemed advisable to operate upon the affected testicle.

He was given two ounces of chloral hydrate dissolved in water via the stomach tube. When the anesthesia began taking effect, he was cast on the left side in dorsolateral recumbency. An area approximately ten inches long and four inches wide was shaved on the lateral aspect of the right side of the scrotum. The area was then thoroughly cleansed and a one to one thousand solution of bichloride of mercury in alcohol was applied to the operati field and a layer of cotton, saturated in t solution, was allowed to remain over the fie for a few minutes.

Thirty cc of a 2% procaine solution was i jected along the proposed line of incision. vertical incision, approximately nine inch long, was made through the skin, and t underlying structures, down to the testicle a cord, were broken down by blunt dissectio The testicles and cord were inclosed in a lar amount of scrotal fat which was removed. intestine was found.

The enlarged cord was tied off, the emasc lator was introduced well down into the i guinal canal and the cord and tunics divid just ventral to where the cord was tied off. T dorsal part of the scrotum, just inside t upper part of the incision, was packed wi sterile gauze impregnated with camphor an septic. One interrupted suture was made the top of the incision and through the gau to hold it in place, and the rest of the incisi was left open to heal as an open wound. T gauze was removed in 24 hours. The wou healed promptly.

The surgery in this was, of course, qu commonplace, but there were two interesti features of this case. One was the diagno we missed and the other was the organi found. Either the scrotal fat misled us in diagnosis of scrotal hernia or there was a lo of intestine when the bull was standing and disappeared into the abdominal cavity when cast him in dorsolateral position. The oth was the normal epididymis, or so we thoug of the affected testicle. On examining t testicle that we removed, we found instead a normal epididymis, an abscess filled w thick, greyish-white pus characteristic of tinomycosis. When cultured, the pus proved be due to *Actinomyces bovis*.

The bull, therefore, probably picked up infection and it localized in the testicle ca ing the severe orchitis, fever and inflammati that was noted earlier. Then when the ac stage passed, the abscess was formed a walled off. The fever and inflammation su sided, the appetite returned and the ani fattened.

The damage to the testicle caused by inflammation rendered it sterile and cau the impotentia coeundi. With the dama testicle and tissue removed there was a cha that the bull could be restored to usefuln since the remaining testicle appeared to uninjured.

JACK PARKE

Byers, Texas.

Cryptorchid on a Cat

May 28, 1946, a high-priced, purebred Siamese tomcat was brought to our clinic. The history was that the cat had been castrated by another veterinarian about two months previously, but still was showing symptoms of masculinity. Upon rectal examination and abdominal palpation a testicle was located in the abdominal cavity, and a cryptorchid operation was recommended.

The operation was performed under ether anesthesia. After shaving the operative area, disinfecting it with alcoholic sublimate and painting it with iodine, an incision of about one-half inch in length was made in the left flank. By inspection a testicle was found, adhered to the abdominal wall, posterior to the kidney. The testicle, which was normal in size and contour, was removed surgically. The incision was sutured and the cat kept in the hospital. Three days later the sutures were removed and on June 5th the cat went home. About a month later the owner said the animal was doing fine and behaving himself.

JOSE A. DIAZ

Rio Piedras, Puerto Rico.

* * * *

Field Observations of Canine Filariasis

The following observations were made on two groups of dogs both in the United States and in the Pacific area. The first group contained 31 dogs, the second 37. Both groups belonged to the United States Marine Corps and were made up of dogs more than one and one-half years of age, either of Doberman Pinscher or German Shepherd breeding.

Canine heart opened to show mass of *D. immitis* in right portion. X 1/3

History of these dogs prior to their arrival on the coast of North Carolina in June and July of 1944 is unknown. At this time the dogs were given a physical examination and from then until September they underwent the process of conditioning and training. In September they were moved to the coast in southern California where they remained until November. From California they were moved to the Hawaiian islands and remained until January, 1945. From Hawaii they were taken to the Riekeu islands and remained until April, at which time they were moved to the Marianas.

At this time only one dog was showing physical signs suggestive of cardiac insufficiency. Heartworm infestation was suspected and samples of whole blood were examined microscopically. *Dirofilaria immitis* was diagnosed.

In group 1, 87.1% and in group 2, 86.4% of the dogs were infested. Due to lack of proper medical supplies, treatment was not started until June. In the meantime an attempt was made to condition the animals so as to better enable them to withstand the treatment.

Treatment consisted of using fuadin (Winthrop Chemical Co.) intramuscularly. The weight of all the dogs being between 50 and 60 pounds an initial dose of 2.0cc was given in the posterior region of the thigh. This was given every day by alternating injections in each leg for six days. No bad results were observed up to this time except a small amount of edematous swelling in the region of the hock. On days when the swelling appeared no treatment was given. This swelling was first noted on the fifth or sixth day of treatment; however, it had subsided sufficiently to resume treatment on the eighth day. At this time the dose was increased to 2.5cc per day. During the next six days of treatment reactions, both local and systemic, were observed in 14 of the dogs, and it was necessary to discontinue treatment for one or two days in seven of this group. If the reactions were not severe the 2.5cc dose was given and no ill effects were noted. This was done in 12 of this group.

Systemic reactions were observed in three animals, keratitis in two, one of which was mild. The third animal had a severe swelling of the head and neck with a rise in temperature 103-104° F. There was anorexia and marked dyspnea. Treatment was temporarily discontinued on this animal; however, it recovered in a short time and treatment was completed at a later date. In the two which developed keratitis a normal eye was observed at the end of two weeks.

Blood samples from each animal were again taken on the 15th day and examined microscopically. In the first group 14.3% remained positive, the remainder being negative. On

those remaining positive 2.5cc doses was given for another six days at which time all dogs were negative.

In the second group 20% remained positive and the same treatment followed as in group one. However, one animal still remained positive and another three days of treatment was necessary to obtain a negative smear.

The animals were not considered free of the parasite until blood smears were negative on three consecutive days.

At the end of 45 days blood samples were again examined microscopically and all dogs were found to be free of circulating microfilariae.

J. F. CARNES

Muskogee, Okla.

Tetanus in a Dog

A female, eight-year-old whippet (mixed), was presented for treatment of an infected toenail on December 30, 1946. The nail was

clipped, the root treated and the dog dismissed, routinely.

The owner called me January 6, 1947, and said the dog was getting very rigid, her eyes were set and her forehead wrinkled. She had labored, accelerated breathing, considerable difficulty in eating, but a ravenous desire for food.

The dog was brought to the hospital for examination and treatment. The symptoms given over the telephone were in evidence and the temperature normal. A diagnosis of tetanus was made.

The following treatment of the dog as an out patient was outlined and followed for nine days. Each day the dog was given 25,000 units penicillin, 20,000 units tetanus antitoxin, 250cc of 5% dextrose solution in normal saline solution, 5cc solu -B- (B complex), and 2cc of nembutal. We recommended the continued use of penicillin for two days at home and the use of nembutal intramuscularly to overcome the rigidity. The animal was given this treatment from January 6th to January 14th. The improvement was gradual and on the latter date

we deemed it advisable to discontinue treatment.

The photographs were made January 12th, just as improvement was beginning to show and February 3rd after recovery was complete.

L. W. COTTLE.

Mobile, Ala.

The Cruelty of Unguarded Traps

In the short period of one week, two cases of leg amputations in pets which had been caught in traps were brought into the Bothell veterinary hospital.

"Lady," a setter-Alaskan husky mixture, was missing from her house for five days. When she returned resembling a veritable "rack of bones," her right front foot was completely severed and the metacarpal bones were exposed and licked clean.

"Tommy," a black tomcat with a friendly white, inquisitive face was probably hunting rodents or romance when caught in a trap. He was brought to the hospital by a lady who adopted him. His left front leg was bent backward and upward due to contraction of the flexor tendons. Following a tenotomy, the leg was straightened and held in a splint. However, amputation had to be resorted to later, due to apparent paralysis of the radial nerve.

Traps, indiscriminately planted on private property and unattended for days, constitute a menace to pets enjoying the freedom of living in the country.

What is there to prevent a roaming child, with a fishing rod over his shoulder and a can of fat fishworms in his hand, from stepping into one of those ugly steel contraptions and possibly maiming the youngster for life?

E. A. SMOKER

Bothell, Wash.